GAS JOURNAL

LIGHT · HEAT · POWER · BYE-PRODUCTS

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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

VOL. CXLII., No. 2871.] TUESDAY, MAY 21, 1918. [70TH YEAR.

EDITORIAL NOTES.

Annual Report of the Council of the Institution.

IT must be acknowledged that, with the work of the National Gas Council, and with war prevailing, the Institution of Gas Engineers has not had of recent years any full opportunity of displaying the power that its corporate state embodies. This must be kept carefully in mind in considering the report that the Council have issued on their proceedings last year, but which could well have been reduced, in the financial interests of the Institution and of the Paper Controller, by half-a-dozen pages if the report of the Gas Traction Committee had been omitted, in view of the fact that it was printed *in extenso* in our pages as lately as April 30. However, although there may be disappointment that there is not more of a technical character in the report, there is the satisfaction of knowing that, as soon as the technical men of the industry are released from the fetters of war, the Institution will be able—relieved of questions of general policy by the National Gas Council, and of commercial matters by the British Commercial Gas Association—to live up to its proper functions as a technical body. There will then be more than ever for it to do, in view of the war-time developments upon gas-works, and the demands of national reconstruction—particularly in regard to the future character of gas supply. The economic conditions of the industry in respect of manufacture and supply are in a position of complete transition; and no outside observer can recognize this with greater fullness than the distinguished President for this year, the Rt. Hon. Lord Moulton, who will take the chair at the meeting a fortnight hence.

In this connection, and that of fuel research, we have one of the most interesting parts of the Council's report, though truth to tell there is at present even here little enough said. There are, however, indications that there is in store for the members the liveliest satisfaction as the result of the work of the Gas Investigation Committee. The Committee lift the veil on what they are doing; but considerably more work will have to be done before they are able to make any recommendations, and, when they do make them, it is probable that a special meeting of the Institution will have to be called to discuss them. It must be remembered that this work may influence the future of gas supply for long to come; and therefore, though there are enthusiasts who have jumped to the conclusion that they know the "last "word" of this matter, the investigation is one that must not lack completeness and definiteness. At the same time, it may be suggested that, apart from their own research, with Mr. James Wood as Research Chemist, the Committee should not neglect, when the appropriate time arrives, investigation into other work. They have done right in beginning their exploration under present conditions of gas manufacture and use; for the gas industry's operations cannot be subject to revolutionary methods, and change must be progressive. But it is to be hoped that, when the present inquiry is complete as to the relative efficiencies in use of different grades of gas made under present-day gas-works practices, and the supplementary one dealing with the economics of gas manufacture by different available methods, investigation will be pursued into possible economies by development upon present manufacturing means. Although the work so far with different grades of gas has been confined to ascertaining comparative efficiences with domestic appliances, and there are still some gaps in it to be filled up, one's interest is sharpened by the statement that "the results so far obtained are of the greatest interest "and value to the gas industry; and they point to a con-"siderable elasticity being desirable in any standard which "should in the near future be adopted for gas."

Another matter of special interest in the report is the question of the guarantee of gas-meters, which was referred to the Life of Gas-Meters Research Committee. The meter makers had suggested a reduction of the period of the guarantee to two years; and therefore the compromise which has been effected by the Committee—composed as it is of the one part of gas engineers and of the other part of representatives of the Meter Section of the Society of British Gas Industries—is very satisfactory. The five years' guarantee is retained for new meters; but the meter manufacturers have secured protection under the contract clauses as set out in the report. Apart from this solution of a difficulty, we have the Committee—the investigation into the circumstances affecting the life of gas-meters being for the present in abeyance—setting-out upon a new line of useful investigation, which should add, firstly, to the economy of meter purchase, stocking, and repair, and, secondly, should do away with a (for these days) senseless system of rating on the basis of "lights." The Committee are at present considering whether the number and sizes of meters usually manufactured cannot be reduced with general advantage, and whether the rating of meters according to their capacity for maximum hourly registration without overstrain cannot be introduced. This would be a basis of rating far more appropriate to current conditions.

There are many other points in the report which will appeal variously according to individual interest. But there is one matter which will at the meeting probably raise a little controversy, and that is the proposal to increase the subscription to 2 guineas for members and 1½ guineas for associate members at a time when, on the surface, the Institution is doing so very little. But it must not be forgotten that the work that is being done applies very largely to the future, that costs for the Institution have gone up the same as for the members individually, and that, in view of the many subjects that have to come before the Council and the expenses involved in travelling, the conferences of the Council cannot be held so cheaply as in pre-war times. We see that the ordinary income did not meet expenditure last year by £183; and this sum has to come from the accumulated funds, which reduces it to £957. This will not do; it is the road to bankruptcy. The Special Purposes Fund derives its income from different sources; and the allocations for research vary from year to year. Last year we see that income was overspent by £405; but fortunately there was a balance of £894 brought from 1916 from which this is deducted. Apart from the Special Purposes Fund, the points mentioned here should be borne in mind if there are any critics of the proposed increase in the subscriptions who intend to speak on the subject at the annual meeting. There may be something to be said on behalf of those members who are managers of small undertakings; and if the hint recently made that any hardship upon such members may be met by graduated subscriptions has any good foundation, this may possibly frustrate any antagonism to the proposals.

We are looking forward to having a good meeting. The honour of having a President of such scientific and judicial eminence as Lord Moulton would alone bring together a large attendance from all parts of the United Kingdom. But these are times when changes are in the making which will have a profound influence upon the fortunes of the industry; and these, together with the ever-hardening difficulties and tribulations of the passing days, induce the desire for conference. Whatever the direct character of the

meeting, the accompanying inducements will be sufficient to ensure a good attendance of gas men in London a fortnight hence.

The Gas Bills Position.

The members of the House of Commons have dispersed for the Whitsun recess, and will not meet again before next Tuesday. Up to the time of the rising of the House on Thursday last, Sir William Middlebrook and his colleagues, who have been considering the "Financial Hardships" Bills promoted by a number of gas companies this session, had not reported their decision. This is of good augury for the promoters, as the terms of the reference were in two parts—the first being to inquire into the expediency of making some temporary modification in the statutory requirements with regard to price and dividend, and the second to decide the terms and conditions on which variations should be made, and whether by Private Bills or by general legislation. The hearing of evidence and of the final addresses by Counsel was completed last Tuesday; and the Committee were privately deliberating on Wednesday. But no report, as said above, had been presented at the rising of the House. If the Committee determined against the expediency of making a change, there would, of course, be no occasion to consider terms and conditions. The delay in reporting to the House may therefore be due to the time required to deal with the more difficult problem; for the first is one which such a Committee would be capable of quickly disposing of. We hope that, in the event, we shall be found right in the deduction made from the delay.

Most of the time of the sittings of the Committee on Monday and Tuesday last week was expended in hearing the two witnesses for the opposition—Mr. W. B. Keen and Mr. W. R. Herring. They were both there to minimize the position or the case of the undertakings seeking relief; and the general impression an outsider might get from their evidence is that misrepresentation is a fairly common characteristic of the gas administrations of the country. Of course, the two witnesses did not say this; but their evidence could not have been better compiled if their specific object had been to prove that there was a good deal that was fictitious and misleading about the accounts of gas companies. But what they did not show the Committee was what advantage is to be gained by sliding-scale companies taking from the consumers—a thing they cannot afford to do now—one penny more than needs compel. Every penny in excess of need is to the disadvantage of holders of gas capital. Much was said which seemed to point to the view that the items of repairs and maintenance are splendid repositories for money extracted from the consumers' pockets; but, if we assume this to be correct, the question as to how the shareholders could benefit from it without sharing the benefit with the consumers at once supplies a negative. Naturally, with the prices of materials and labour what they are, repairs and maintenance must be heavy. We will not say much of Mr. Herring's evidence. He set out to spread destruction over the case of the promoters by having recourse to a mass of detail; but, for one in his position his seat in the witness chair towards the close of the sitting was not quite so comfortable as it had been under the friendly lead of the Counsel for the opposition. However, Mr. Herring holds the opinion that the present state of affairs was foreseen when the sliding-scale was first of all taken into consideration. In other words—there can be on other construction placed upon the submission—Mr. Herring seems to believe that Parliament deliberately legislated for a condition of things that should result in dividends tumbling down to a mere shadow of what they ought to be for a commercial undertaking, and at a time when the demands upon the recipients of these dividends would be unprecedentedly heavy.

To financially cripple and debilitate industrial and commercial concerns is, of course, a very senseless proceeding. The thought recurs as one reads the opposition evidence, especially that of Mr. Keen, the Chartered Accountant. He appears to have lost all sense of feeling for the holders of gas capital. In his view, they seem to have done extraordinarily well in the past, and so can afford a good slice of sacrifice in the present. We have not found, taking gas capital through and through, that it has received dividends that have been of a remarkable character for trading undertakings. Nevertheless, Mr. Keen was ungenerous in some of his statements, and, to our way of thinking, humorously illogical. Whether Mr. Herring felt altogether comfortable while his companion was expressing some of his views, we do not know. But, like Mr. Herring, he indulged in a little metaphysical speculation as to what was in the minds of the Legislature at the institution of the sliding-scale. He thinks that the Legislature of those days considered it was a fair bargain, which would hold under all circumstances. He also regards the effect of the war on the price of coal as being the same as a coal strike. It would be a remarkable coal strike that lasted four years, and without human knowledge as to its further duration. However, Mr. Keen, though able to hazard an opinion as to what was in the mind of the Legislature a great number of years ago, was quite unable to say how long the war is going to last. The promoting companies will be mightily pleased that it was not Mr. Keen who occupied the place of Sir William Middlebrook; for he gave it as his opinion that gas companies should go on as they are until they have exhausted all their reserve funds, and have suffered loss to the extent of the benefits that they have received over the standard dividend of past years. This is extraordinarily ungenerous. But to be logical Mr. Keen should have added that the consumers should also give back all the reductions they have had in past years below the standard price to help to meet the extraordinary burdens of present times.

These are among the views that, in addition to figures and analytical data, were seriously placed before the Committee; and such points were all to the good of the case of the promoters, as we confidently hope and believe the issue for which we are now waiting will show.

Rationing Revision—Coal and War Materials.

The report of what the President of the Board of Trade (Sir Albert Stanley) said in the House of Commons last Wednesday on the question of rationing will be read with mixed feelings by both gas and electrical men. There will be an amount of satisfaction over his announcement that the gas and electricity rationing order is undergoing revision in conjunction with coal rationing for householders; but this satisfaction will not extend farther than the publication of the new scheme if it then be found that the terms are such as to make muddle worse confounded. Co-ordination of the use of coal, gas, and electricity is by no means a simple matter which can be dealt with off-hand; and therefore nothing should be done without strict analytical consideration is given to every detail and all possible effects. It does not do to accept or reject new plans on the first blush. They sometimes do not turn out quite as first appearance or early acquaintance represents them. There is no hurry for a week or two in this particular matter. The season is a most convenient one for fully discussing it, and putting it securely on a sound foundation. The five-sixths ration had better for a time continue to bear the assaults brought upon it by its immaturity, and its callous indifference to loyalty and disloyalty to former requests for patriotism in economy, than to supersede it with something which may be infinitely worse either from the suppliers' or the consumers' points of view. The plan of rationing now in mind, according to Sir Albert, runs on lines similar to those adopted when the consumption of coal was rationed last winter, by taking account of the size of the establishment, and, it is now further proposed, in particular instances, to consider the number of people occupying the place. In our opinion, the latter is the more important factor; for the higher the number of people residing in a house, the more the quantity of light required, the more the cooking, the more the heating—in fact, in every way, the need for light and heat is increased.

We do not know from whom the President of the Board of Trade obtained his information that the gas and electricity rationing scheme in the southern area of England has worked "fairly" well. The qualifying term suggests that it has not worked quite so well as was expected by Whitehall and Holborn Viaduct. We are not surprised at this, although gas undertakings have done their best, and Sir Albert thanked them, for there has been, in the result, some economy in the consumption of coal. There is, however, nothing but the registrations of the station meters upon which the President could have based his statement; and we venture the opinion (because we know there is safety in doing so) that the station meters of all gas-works in the area do not show that, so far this quarter, the rationing scheme has worked even "fairly" well. The end of the quarter may, if the weather is bright and light the next few weeks, turn the "fairly" into "very;" but, if the weather is dark,

wet, and chilly, it may be that even the "fairly well" will lose all title to respect, acceptance, or fitness. However, the attempt that is being made at co-ordination between coal, gas, and electricity, should be accompanied by making waste a punishable offence. We admit the difficulty of discriminating as to what is waste. There is, however, waste that is markedly so. There is, for example, the waste that occurs in using coal for the generation of electricity for heating purposes of any kind. The coal can be put to much better use than that. There is the waste that occurs in households by burning coal when gas or coke is available for the same service. There is the waste of gas and electricity in factories by leaving in use appliances during the dinner hours, and lights going unnecessarily. There is the waste in the streets by supplying current to darkened arc lamps when 60-watt incandescent lamps would give the same amount of light with proper fitting. In Westminster alone, some 2000 tons of coal per annum could be saved by such conversion. There is the exuberant electric lighting used on the underground railways, which means unnecessary coal consumption. These and other forms of waste are but illustrations which can be picked out of the report in our news columns of a discussion on the subject at the meeting of the Illuminating Engineering Society on Tuesday last. They are instances of remediable waste, for which innocent and economy-practising people have to suffer under an arbitrary rationing scheme.

In the opening paragraph we referred to the announcement of the President regarding rationing being received by gas and electrical engineers with mixed feelings. As opposed to the satisfaction felt over an honest attempt to modify the conditions of coal, gas, and electricity rationing, so that these agents for light, heat, and power shall have a correlative part in the scheme, there will be some dissatisfaction concerning the President's intimation that the coal situation next winter will be much worse. This is not a very pleasant contemplation. That it will be much worse is more particularly due to the deficiency of railway facilities. But whose fault is this? While Sir Albert tells us one minute that hundreds of locomotives and many thousands of wagons have gone to France, the next minute he informs us that there are thousands of locomotives lying idle requiring repair. Seeing how vital it is to the national welfare and to the military position that the means of transport should be maintained at the maximum possible efficiency, it does not appear to be particularly good statesmanship, nor evidence of foresight, to admit such an accumulation of locomotives unfit for action, and not only locomotives but wagons. How long is this sort of thing going to continue, before there is a complete breakdown in the railway system of the country? Within twenty-four hours of the time that Sir Albert made his ominous statement as to coal, there was published a notice, under the Defence of the Realm Act, of new regulations empowering the Admiralty, the Army Council, and the Ministry of Munitions to require the manufacture or production of gas to be carried out in accordance with any directions given, with the object of making it as useful as possible for the production of any war material or any articles needed in connection with the production thereof, and in particular to require that all toluol, benzol, and other hydrocarbons contained in the gas produced, or any other constituents, shall be extracted by scrubbing or otherwise before being supplied to the consumer. Perhaps the Admiralty, the Army Council, and the Ministry of Munitions will enter into arrangements with the Coal Controller to supply gas-works with the full quantity of coal necessary for the purpose of making the gas and the tar from which the required products are to be extracted; and at the same time they might drop a word in the ear of Sir Albert Stanley that the maximum delivery of these products to them depends upon the supply of the maximum demand for coal gas within the resources of the gas-works. The gas-works can promise that the coal will be utilized with a frugality unexampled outside the gas industry. Not only will so much gas and coke be put upon the market as fuel, but all Government Departments will have their demands either completely or very largely satisfied.

Pyrites and Spent Oxide—Sulphuric Acid and Sulphate Prices.

MORE than once remark has been made in these columns as to the need of co-ordination of the work of the different Government Departments, in order to produce the maximum economy for the country—economy which is more necessary now than it has ever been. Nowadays one frequently finds oneself in perplexity when trying to fathom reasons for departmental proceedings which are apparently contradictory. Last week, for example, we published a new scale of prices for sulphuric acid, which adds 6s. a ton to all qualities; while this week an article is published from our contributor "Cricket," who avers that there is now an abundant supply of sulphuric acid, and that he hears that manufacturers have been requested to diminish the output of their plants. When the previous increase of price was made, a manufacturer and consumer of sulphuric acid assured us that there was no real justification for such high charges. As a manufacturer he must have known what he was talking about; and, be it marked, the prices are controlled ones! If the law of supply and demand rules in war times as it is supposed to do in peace times (which even then it does not always do with some commodities—coal, for example), and our contributor is correct as to an abundance of supply, then there is no reason in the additional price that has been fixed for sulphuric acid. We will presently advert to the question of the relation of the new controlled prices for sulphuric acid to the new controlled prices for sulphate of ammonia.

Before doing so, however, there is a point to be emphasized, which "Cricket" makes. With the abundant supply of acid, there is no longer any necessity for the importation of pyrites, as the whole of the sulphuric acid now required could, he asserts, be made from spent oxide. Here, again, we have an illustration of how many of the proceedings of different departments are innocent of any attempt at co-ordination, and so the economic interests of the country suffer. Here are ships being employed to bring pyrites from a long distance while at the very doors of the makers of acid is material which is accumulating because they do not absorb it all; and yet all that is required is a comparatively simple and inexpensive change in the furnaces of the pyrites acid makers—a change of an infinitesimal order compared with the cost of bringing pyrites from abroad. With the pyrites comes a good deal of useless material; so that tonnage is further unprofitably utilized which could be more profitably employed in conveying coal from the North. In addition, gas-works are wanting more oxide for purification purposes; and the accumulating spent oxide would, after treatment at the acid makers' works, afford relief in this direction to gas undertakings. Another inducement that should weigh with the acid makers in using the home produced spent oxide is that the acid made from it is non-arsenical, which naturally is more useful than the arsenical variety made from pyrites. The Ministry of Shipping and the Ministry of Munitions are interested in these conditions; but what possible reason can they have for permitting this combination of uneconomies to continue, when every shred of economy is nationally necessary? We at all events, cannot even conjecture. But to the observer interested in economical shipping, economical sulphuric acid production, and the utilization of spent oxide and the more plentiful supply of burnt oxide, it seems that something should be done to regularize these things in the national interests. Every economy helps; every piece of uneconomy adds something to the onerous conditions of the times. [Since this was written, information has reached us that the matter dealt with is now receiving consideration.]

Now regarding the new prices of sulphuric acid in relation to the home prices of sulphate of ammonia for the season 1918-19, it will be remembered that, in the recent announcement as to the latter, it was stated that the prices were subject to "any rise on the present prices of acid, on "the basis of 11d. extra on sulphate for every 1s. extra on "acid." The revised prices for sulphuric acid mean an all-round increase of 6s. per ton; and therefore the maker of sulphate is entitled under the fresh settlement to six times elevenpence increase. He will not, however, make the additional charge himself, but will receive from the Ministry of Munitions extra compensation at the rate of 11d. per ton on sulphate for each further 1s. per ton paid for acid.

Rationing and the Government Departments Concerned.

In view of the new regulation which gives the Admiralty, the Army Council, and the Ministry of Munitions power to compel the manufacture and treatment of gas in such manner as is most desirable in the national interests, and in view, too, of the importance of the source of the materials required by these departments

not being interfered with to the detriment of quantity, "Cricket" urges, in an article which [owing to Bank Holiday necessitating early printing] arrived too late for inclusion in this week's issue, that there should be no final settlement of the scheme for coal, gas, and electricity rationing without the departments above mentioned have a voice in the matter. That is common sense; but what say the Board of Trade?

Blending Coal and Coke for Boiler Firing.

An article in another part of this issue is of particular interest in view of the increasing restrictions in the use of raw coal as fuel at power stations. One of the features of the communication is a description of an apparatus (for which an application for a patent has been filed) for firing coke and coal on chain-grate stokers in two or more superposed layers. This is a development due to the Engineering and Fuel Expert of the London Coke Committee (Mr. E. W. L. Nicol). The arrangement has been adopted by the London County Council Tramways Department. The results of actual working incorporated in the article show that there is, using the blended coke and coal, a substantial improvement in efficiency compared with raw coal alone.

Synthetic Ammonia.

In the House of Commons recently, Mr. Kellaway stated that, through the Munitions Inventions Department, some dozen departmental patents have been taken out for the modification of the celebrated Haber process for fixing atmospheric nitrogen in the form of ammonia. "The Times Engineering Supplement" asks if it is realized what Germany is doing in this matter. She is looking beyond the war. The Haber process has been made a State monopoly; and systematic work will extend its field of utility by taking advantage of the fact that carbonic acid is cheaper than sulphuric acid, and that with its aid ammonia can be made to yield a fertilizer "far superior" to sulphate of ammonia. Containing 43·7 p.ct. of combined ammonia [home prices are now on a 24½ p.ct. basis], the fertilizer "Urea" is said to be of exceptional efficacy. Our contemporary concludes that "with a process for manufacturing it cheaply on a large scale, and with practically a world monopoly of potash, Germany will command a position of pre-eminent advantage—not only for the improvement of her own agricultural productiveness, but for supplying other nations with fertilizers."

Continuously Worked Horizontal Retorts.

The same contemporary has an article describing the patented plans of Messrs. John West and W. Wild for continuously acting horizontal retorts. Extracts from the patent specification were given in our "Register of Patents" on April 16. Those who read the specification will have seen that the patentees are proposing to apply some of the methods incorporated in the Glover-West continuous vertical system to retorts horizontally placed. Of course there are differences. The charging is by means of a plunger, worked by hydraulic power, and situated in a chamber which receives coal from overhead storage—a special valve preventing the escape of gas. At the opposite end of the retort is a downwardly extending chamber, through which the coke is discharged by gravity at intermittent periods. Above the coke chamber is the gas ascension-pipe. The principle of zones of graduated temperature is applied; but, contrary to the new vertical retort practice in the interests of liquid fuel production, the most intense heating is arranged for at the inlet end of the retort. The temperatures are graduated through three zones; and in the third one from the inlet end (here, again, we get a feature of the Glover-West continuous vertical retort), heat is extracted from the hot travelling charge by passing round the exterior of the retort the secondary air for the combustion of the producer gas.

Coal, Nitrogen, and Other Points.

Looking about for a reason why the co-inventor of a highly successful system of vertical retorts should turn his attention to the evolution of a horizontal method, the writer points out that, "so long as Durham coal is employed for gas making, as is largely the case in the South of England, so long will the horizontal retort be regarded as most serviceable—not from the point of view of ideals, but for the fact that it is certain in its operation in practice." In this connection, the writer does not mention the recent proposal of Mr. Thomas Glover, as to the grading and working of coal. It was evident from the remarks made at the Southern Association meeting, that he had Durham coals particularly in mind. Surprise is expressed at the claim made for the continuous horizontal system, that it is capable of giving a greater yield of gas per unit of ground space than can be obtained with the continuous vertical systems. Probably the specification was drafted before the modern experience was gained with the steaming of charges in vertical retorts. One claim obviously cannot be questioned—that is the reduction of head room compared with the continuous vertical retorts. It is thought that Messrs. West and Wild have provided here a starting-point from which both nitrogen recovery and water-gas production may spring. "Large coke chambers are a feature of the plant; and it would seem highly probable that, with a modification of the temperature zones, and the elimination of the principle of secondary air heating, they should be able to bring to perfection, beyond the ideal of continuous carbonization, the recovery of an element in the coal which has been neglected far too long."

Gas Affairs in Australia.

While progress during the final six months of last year was not, in the case of the Australian Gas Light Company, so great as could have been wished, the Chairman was able to inform the shareholders at the recent meeting that the number of consumers showed a substantial increase. In fact, in this connection, the disturbed conditions existing have led to difficulty. Shortage of meters, arising from the restrictions upon exports from England, has rendered it necessary to make temporary arrangements in the matter of gas charges, to meet demands of would-be consumers; while a great many applications for extensions have had to be held over pending the obtaining of additional capital. Apart from the manufacturing and distribution departments, the Chairman, it will be seen from our report of the meeting, referred to a recent amendment of the Gas Act of 1912. Under the original Act, the Company were entitled to increase the standard price of gas in accordance with any increase in the price of labour; but the same provision was not to apply if the cost of coal, oil, &c., rose above the level existing when the Act was passed. The amending Act sets this right; but, at the same time, the standard rate of dividend is reduced. However, it seems that the standard price of gas was originally fixed too low to allow of the payment of the rates of dividend specified in the old Act.

Coal Miners Want More.

The gas industry, among others, is still biting wrathfully at the half-crown that was put retrospectively upon the price of coal, in consideration of the increase in miners' wages last autumn. This was a hard infliction for the industry, with its coal contracts made, its charges for gas based on these contracts, and the payments for its secondary products so largely under control. From that time those who, among gas administrators, were far-sighted, have declined to say whether or not the end has been reached in respect of higher coal costs. They were wise. There is already a further movement on the part of the coal miners for another application for a general advance in wages; and there is to be a conference of delegates of the Miners' Federation in London on June 5 to take the matter of an application into consideration.

Dyes Protection.

There will be a great deal of satisfaction in the country over the fact that, in connection with dyes, the Government have now agreed to put up, for a decade, some good bulwarks against German competition in the British dye market. Without this protection, the Government would simply be exposing an industrial child of largely its own creation to the, as soon as war was over, murderous attacks of the commercial Huns. To place the dye industry of the country on its feet, it was absolutely necessary to give it time under peace conditions. The announcement that this was to be done was made by Sir Albert Stanley in the House on Wednesday. The line of protective action is to control the importation of foreign dye stuffs by a system of licences for a period of not less than ten years after the war. This gives the Government a right to make an extension of the period if they think desirable. The Government are also rendering financial assistance to makers of special classes of dyes; and the backbone of the dye industry, it is proposed, shall be further strength-

ened by the amalgamation of British Dyes, Limited, and Messrs. Levinstein, Limited. The new Company will be permanently under British control, with Government representatives on the Board of Directors. How the German dye makers will anathematize those who have been guilty of turning the valves against them of that formerly open pipe-line for dyes which so handsomely helped to enrich the Fatherland before the war! America and Japan are now looking after their own dye-making; so that the Germans will have an opportunity of putting on the scrap heap any surplus plant which they may possess.

PERSONAL.

MR. GEORGE R. HISLOP.

MR. GEORGE R. HISLOP, who in 1915 celebrated his jubilee as Gas Engineer and Manager to the Paisley Corporation, and has thus now 53 years' service to his credit, has tendered his resignation. His appointment as Manager of the works dates back to May, 1865; and some details of the work he has accomplished since then will be found in the "JOURNAL" for July 20, 1915. When the minutes of the Gas Committee which contained the announcement were under review at the Council meeting, Provost Robertson remarked that it would be within their recollection that in 1915 Mr. Hislop completed his fiftieth year as a servant of the Corporation. They recognized his long services at that time by presenting him with a silver salver, on which were inscribed the names of the members of the Town Council. He was sure he expressed what was present in the mind of everyone when he said that they had all appreciated the valuable services Mr. Hislop had rendered during the long period he had been with them. They had benefited by his great skill as an engineer and as a manufacturer of gas, and hoped that in his retirement he would have the pleasantest recollections of his association with them. He wished, in their name, to convey to Mr. Hislop their sincerest thanks for the services he had rendered to the community, and to extend to him their best wishes that he might be long spared to go in and out among them. Bailie Henderson (as the Convener of the Gas Committee) said they all regretted that, with advancing years, Mr. Hislop had decided to retire from his lengthened and valuable services as Engineer and Manager of the gas-works. For a long period, he had been deservedly regarded over the length and breadth of Scotland as an authority on everything connected with the manufacture and distribution of gas. Many gas-works profited by the adoption of his patents. His principal invention was Hislop's patent regenerative system of heating the retorts, which reduced the fuel account by 40 p.ct., and the price of the town gas from 3s. 9d. to 2s. 10d. per 1000 c.ft. Perhaps the highest testimonial he had earned was in being instrumental in applying gas profits, amounting to £150,927 since the passing of the Gas Act in 1875, chiefly for the relief of the rates. His long and faithful services were highly appreciated by the Town Council, and he was sure by the whole community, as well as by many others who had sought his advice and counsel regarding similar undertakings.

In the general office of the Manchester Corporation Gas Department last Wednesday, Mr. FRED MOFFLIN, Senior Receiver, was presented by his colleagues with a gold watch and chain, in commemoration of his fifty years' service in the department, and Mrs. Mofflin with a gold wristlet watch. The Superintendent of the Gas Department (Mr. Fredk. A. Price) presided; and the presentation on behalf of the officials was made by the Chairman of the Gas Committee (Alderman W. Kay, J.P.) and Mrs. Richard Burtles (wife of the Deputy-Chairman) respectively.

French Professional Syndicate of the Gas Industry.—We owe to the courtesy of the French Professional Syndicate the receipt of the bulky volume which witnesses their many and various activities during 1917. These labours, like those of the previous years of the war, have been of a twofold character. The Syndicate, as representing the business interests of the gas industry in France, have made it part of their duties to circulate and to interpret the numerous Acts and Orders affecting gas undertakings in such matters as the supply of raw materials and the disposal of manufactured products. In this work they have plainly been actuated by a desire to contribute to the national effort in the prosecution of the war, while seeking at the same time to conserve the rights of members. In this latter aim, they have been able to devote themselves with a more single purpose to watching and reporting to those in the industry the cases in the Courts in which terms of concession, the price of gas, thefts by consumers, insurance, labour, and other matters have been the subjects of legal action. The volume is a collection of the actual circulars distributed among the Syndicate's members during last year, to the total number of 65. Included in it also are articles from the Paris press on some of the political projects which have arisen from pre-war contracts, and in which an effort has been made to destroy the effect of the equitable judgment of the Conseil d'Etat in the notable case of the Bordeaux Gas Company.

AGENDA FOR THE INSTITUTION MEETING.

Tuesday and Wednesday, June 4 and 5.

THE Annual General Meeting will be held at the Institution of Civil Engineers, Great George Street, S.W., on Tuesday and Wednesday mornings, the 4th and 5th prox.—under the presidency of the Rt. Hon. Lord MOULTON, G.B.E., F.R.S. The chair will be taken each day at 10.30.

On Tuesday, after the presentation of the minutes and the appointment of Scrutineers, the Birmingham Medal will be presented to Mr. John West. The President will then deliver his address; the question of increased subscriptions will be considered; and the sitting will close with the presentation of the Council's report and the accounts.

The proceedings on Wednesday will open with the meeting of the Benevolent Fund. This will be followed by the report of the Refractory Materials Research Committee, to be presented by the Chairman (Dr. Harold G. Colman). There will also be considered the election of an honorary member, and the place of next year's meeting.

FORTHCOMING MEETINGS.

IN addition to that of the Institution of Gas Engineers, the *agenda* for which is noticed above, several important meetings have been arranged to take place during the next two or three weeks.

British Commercial Gas Association.

We are asked by Mr. W. M. Mason (the Secretary), as the matter may be of interest to a number of members of the industry who will doubtless be in town for the Institution meetings, to announce that a meeting of the British Commercial Gas Association General Committee is to be held on Monday, June 3, in the Council Room, Caxton Hall, Westminster. At the conclusion of the ordinary business, a paper will be submitted for discussion by Mr. H. H. Creasey, on the topical question of "Gas *v.* Electric Cooking in National—and Other—Kitchens." As this is a subject of considerable importance at the present time, a hearty invitation is extended to any representative of a gas undertaking—whether or not a member of the British Commercial Gas Association—to attend the meeting and join in the discussion. Visitors will be welcomed at 3.45 p.m.

Manchester District Institution.

There will be a quarterly meeting of the Manchester District Institution of Gas Engineers at the Midland Hotel, Manchester, on Wednesday, the 29th inst., at 2.15 (under the presidency of Mr. J. P. Leather, of Burnley), when the following subjects will be discussed: (*a*) Joint Industrial Councils—Reports of the Whitley Committee, to be introduced by Mr. S. Tagg (Preston). (*b*) The Technical Library's Report, to be presented by Mr. H. Kendrick (Stretford). (*c*) The Lighting, Heating, and Power Order, 1918.

Southern Association.

On Thursday, the 30th inst., the Southern District Association of Gas Engineers and Managers are, by invitation of the Directors, to inspect the gas-works at Ilford (the home of their President, Mr. W. B. Farquhar). After being entertained by the Company at lunch, there will be a visit to the Chingford reservoir of the Metropolitan Water Board, to see the Humphrey pumping-engines at work. Though the times are difficult, the Committee trust that members will make a special effort to be present.

Wales and Monmouthshire Institution.

A meeting of the Wales and Monmouthshire District Institution of Gas Engineers and Managers will be held on Wednesday, the 29th inst., at 11 a.m., in the Council Chamber of the Margam Urban District Council, Port Talbot, when the chair will be taken by the President, Mr. J. Mogford. There will be a discussion on the paper read at the last meeting by Mr. W. H. Cattell (Swansea), on "Promoting Gas Sales;" and a paper will be presented by Mr. Evan Rees (Margam), entitled "Bye-Product Coke-Ovens as a Source of Gas Supply for Town's Use." After lunch, there will be a visit to the new steel, iron, and coke-oven plants now in course of construction for Messrs. Baldwins, Ltd., and also to the Margam Council's gas-works.

Waverley Association.

The annual meeting of the Waverley Associatien of Gas Managers—under the chairmanship of Mr. John Richmond (Penicuik)—will be held in Edinburgh, on Thursday, June 13, when the Presidential Address will be followed by a discussion.

At the Bradford City Council meeting last Tuesday, a long list of increases of salary to municipal officials was considered, including Mr. Charles Wood (the Gas Engineer) from £800 to £1000 a year; and Mr. E. J. Sutcliffe (the Deputy Gas Engineer) from £350 to £450. All increases were made conditional on fees received by any official in respect of work done for a Government department or other public authority being handed over to the Corporation.

NEW ORDERS AFFECTING GAS-WORKS.

War Material from Gas-Works.

Power is conferred by a Defence of the Realm Regulation on the Admiralty, the Army Council, and the Minister of Munitions to require the manufacture of gas in any gas-works to be carried out in such a way as to make the works or the labour in them as useful as possible for the production of war material—particularly toluol, benzol, and other hydrocarbons. The staff of the gas-works must obey any instructions received from the Government Departments mentioned, notwithstanding the requirements of any statute or statutory order with regard to the illuminating or calorific power of the gas supplied.

Ammonia Control Order.

An order has been made by the Minister of Munitions (to be known as the Ammonia Control Order, 1918), directing that no person shall, as from June 1, produce or manufacture any ammonia or ammoniacal product, except under licence. No licence is to be required to manufacture (*a*) crude ammoniacal liquor or sulphate of ammonia in any quantities; (*b*) any other ammoniacal product in quantities not exceeding half a ton during any one calendar month. No person shall supply any ammonia or ammoniacal product (other than crude ammoniacal liquor or sulphate of ammonia) to any person, except under licence; but no licence shall be required to supply not more than 56 lbs. of anhydrous ammonia, or 1 cwt. of ammoniacal liquor or any ammoniacal product to any person during any one calendar month. All persons engaged in producing or manufacturing ammonia, or any ammoniacal product, or in any manufacture, trade, or business in which any ammonia or ammoniacal product is used, shall carry out and comply with all instructions and directions which may be issued or given by, or on behalf of, the Minister of Munitions with a view to avoiding loss or waste of ammonia. All applications in reference to the Order (including applications for licences) should be addressed to the Ministry of Munitions, Department of Explosives Supply, Storey's Gate, Westminster, S.W. 1, and marked "Fertilizer Section."

ELECTRICITY SUPPLY MEMORANDA.

The electricity rationing scheme, as is now generally known, is undergoing revision; and certain figures have already been adopted, but not yet been made public. A search is being made for equivalents, which will embrace coal, gas, and electricity consumption. A consumer who uses so much coal, gas, and (or) electricity will, it is believed, be allowed the use of so much extra gas or electricity according to the reduction of his coal consumption—whether upon the quantity used during a stated period or upon his existing coal rationing is not yet known. But anyway it will be something of the kind. At the same time, the individual's consumption of coal directly, or indirectly through gas and electricity, has to be reduced, whether or not he likes it. This is of far more importance to gas than to electricity, for the amount of cooking that is done in the electric way is almost *nil*, and the amount of electric "heating" only touches the fringe of the heating business—nothing more. Thus during the summer months the electricity industry cannot hope to benefit much as against coal from any modification of the gas and electricity rationing order. But we would urge that a householder who gives up coal for gas deserves the equivalent of more than (say) 12,000 or 13,000 c.ft. of gas per ton; for the ton of coal at the gas-works produces not only 12,000 or 13,000 c.ft. of gas, but about 10 cwt. of coke for sale, besides other valuable things. Therefore, a gas consumer for his renunciation of coal deserves at any rate in addition part of the coke. On the other hand, the coal used for supplying the electricity consumer produces nothing but the electric current; and the more electricity he is allowed to use for heating purposes, the worse becomes the coal position, for the coal will do better in the house grate than under the boilers at the average electricity station. A point that Government Departments should take into account is that the domestic coal heap has to be attacked with the view of helping as much as possible the objects of all Government Departments. The Coal Controller and the Ministry of Labour are jointly interested in coal transport and distribution and the labour required in handling; while other departments badly want the products of coal carbonization—the Ministry of Munitions, the Admiralty, the Army and Naval Medical Departments, the Board of Agriculture, and so on practically throughout the whole gamut of them. It is for the Board of Trade to remember this in revising the rationing order.

Rationing Revision.

Attention has often been directed in the "Memoranda" to the fact that aircraft bombardments have introduced a new consideration into the question of super-stations, or big concentrations of electric generating plants. Of course, the super-station men superciliously smile over the danger. We are, they aver, going to have a long term of peace after this war has produced its exhaustion of the Central Powers. We all hope so; but no one can say definitely. It will be too much to hope for a perpetual peace; and the military authorities will have to consider the bearing of new civil plans upon the protection and defence of the country, as well as upon national interests. The military authorities have had satisfactory intimation given them as to the danger of any large concentrations of electricity plants by the performances of Italian and British airmen at Cavedine. Formerly there existed there a big hydro-electric power house. Recently, airmen in four or five hours dropped such a tonnage of high explosives on the place that its activity was completely destroyed; and when it will be able to resume its activity is a problematical matter. Meanwhile, all industrial establishments depending upon this power house have had their electric energy supply cut off; and their machinery is standing idle. Incidentally an electric railway which formed an important item in the Austrian line of communications has fortunately been deprived of its power to render its usual service. The lessons of this incident are of both military and national importance; and they should be applied in determining the plans for the reformation of national electricity supply. Every day air warfare grows stronger. The capacity of the machines for destructive work has been increased, and is still increasing; and the range of their operations has been enlarged, and is enlarging.

Super-Stations and Aircraft.

What do Mr. Merz and his fellow-members of the Coal Conservation Sub-Committee on Electric Supply think of the powerful municipalities on the North-East Coast? The report of the Sub-Committee held that the North-East Coast companies were everything that was saintly, sane, and all else that is desirable in electricity supply. Mr. Merz, as a member of the Committee, was no doubt highly gratified by the views expressed by himself and his colleagues of the Sub-Committee. Other professional men have voiced opinions not quite so favourable. But if everything is so perfect in regard to electricity supply on the North-East Coast, it is strange that the municipalities there in combination do not endorse the report. The Corporations of Newcastle-on-Tyne, Darlington, Stockton, West Hartlepool, Middlesbrough, South Shields, Tynemouth, Sunderland, and Berwick have had a conference, at which they have passed a resolution which (while recognizing that the unification, production, and distribution of electrical energy over areas sufficiently large and carefully defined is desirable) does not concur in the recommendations of the Coal Conservation Sub-Committee. They have therefore decided to appoint a Committee to consider the report and to prepare a reasoned statement in relation thereto. This is all very interesting, seeing that Mr. Merz and his colleagues held up the electricity supply of the North-East Coast as something which should be emulated in connection with the reorganization of electricity supply on a national basis—at any rate, while they found imperfections in most other electrical engineering work, they could not discover anything to equal, much less to excel, the system on the North-East Coast. Then why should the municipalities in question be taking up the attitude they are doing? They do not, surely, imagine they can improve on the best.

Opposition on the North-East Coast.

Though the electricity industry has, like the gas industry, had to face a heavy increase in the costs of coal, the undertakings that have been in the position to have modern generating plant have not suffered, in comparison with some years ago, to the extent that they would otherwise have done. The same remark applies to the gas industry, though not to the same extent, as there has not been room for it to more than double its output per ton of coal, the same as in the electricity industry. The gas output per ton has been considerably increased; and it has been enlarged still more by the utilization of steaming or blue water gas. Some illustrative figures of what has been happening in electricity stations are supplied by Mr. Charles Furness, from his experience as the Corporation Electrical Engineer of Blackpool. In 1902, 15,289 tons of coal were used there, at a cost of £7867. In 1904, the consumption was 14,869 tons; the cost being £7302. Last year the consumption was 14,324 tons; and the cost £13,759. Thus it will be seen that the cost per ton last year was nearly double that of 1904. It will be observed that in 1902 and 1904 the consumption of coal was somewhat more than last year. But, notwithstanding, the number of units generated last year was upwards of 4 millions more; the actual units generated being 2,262,516 in 1902, 2,570,180 units in 1904, and 6,375,398 units last year. Working out the figures, it is seen that there was immense scope at Blackpool for improvement. Just imagine the 1902 consumption of upwards of 15 lbs. of coal per unit generated! Last year, it was 5·03 lbs., which compares very badly with the figures so often quoted of 2 lbs. and under per unit, which, of course, is more of an ambition than a reality. Where such a consumption prevails, there are exceptional circumstances. Nevertheless, it gives electricians some satisfaction in writing and speaking as though such an ideal efficiency was getting as universal as (say) gas cooking and heating.

Coal Consumption and Prices and Electricity Production.

The Rochdale Electricity Committee appear to be in a tight financial corner. They have an accumulated deficit; and they are going to apply the depreciation fund to its liquidation—a piece of financial folly which was at the recent meeting of the

Unsound Finance.

Council described by one member as "dangerous and unsound," and by another amazed and trenchant critic as "the most rotten finance possible." Both were about right. A third critic pointed out that electricity plant has cultivated a habit of depreciating quickly; while still another declared that, on a capital outlay of nearly a quarter of a million a sinking fund of £54,000 and a depreciation fund of less than £10,000 were inadequate. The defence of the Committee was fearfully weak. The Chairman pointed out that the plant did not depreciate so quickly as had been anticipated; while another member said a portion of the machinery had been sold for four times the amount at which it stood in the books. The report does not tell us what the Committee "anticipated" as being the rates of depreciation; much depends on that as to the value of the statement of the Chairman. Depreciation, too, of the generating plant has some connection with the pressure or otherwise at which it is worked; and during war time when this absorption of the depreciation fund is being made, there is a bigger pressure than ever upon the plant (or there is in most stations) and so the rate of depreciation must have been intensified. It is the worst possible time of all to dissipate a depreciation fund without seeing something tangible for it. As to plant being sold for four times the amount at which it stood in the books, even a second-hand kitchen table in decent condition will during war time fetch an amount in excess of its pre-war value. Exceptional circumstances are no argument for the dissipation of a depreciation fund. The whole fact of the matter is that the Rochdale Electricity Department has not been financially managed as it ought to have been. A concern of the kind in Rochdale should be run so that income will meet all the outgoings whatever be their nature. But this has evidently not been the case; the statement as to the "accumulated deficits" shows this. The only thing that can be said in favour of the Rochdale course is that to the extent the depreciation fund liquidates the deficit, the ratepayers are saved a deeper dip into their pockets. It is to be hoped that the new increases in the prices for current will be sufficient to obviate any further deficits. We see that the charges to lighting consumers are to be increased by 50 p.ct. on the pre-war rates, and the rates for power are again to be advanced.

Sanity in Street and Shop Lighting.

Sometimes we are in agreement with "Electrical Industries;" but more often than not in regard to matters in which we are immediately interested, there is disagreement. However, this happens because of a difference in the point of view, and because frequently different factors are brought to bear upon the consideration of the points at issue. On this occasion, we are much in harmony with our contemporary. It has been writing on street lighting and safety in connection with a series of recommendations made by the "Safety First" Council. These recommendations urge that contrasts in roads of brightness and darkness which are dangerous to traffic should be avoided, and that a diffused substantially uniform illumination should be provided in all districts. There is no particular reason for the next recommendation while the Lighting, Heating, and Power Order remains in force. It is submitted that, where danger is liable to be caused to traffic by reason of the excessive contrasts of shop lights, luminous signs, &c., they should be screened so as to shed only a diffused light on the public way. This is a matter over which we hope to see some definite ruling after the war; but with the suppression of lights in and outside shop windows, there is no reason for making any law now. Perhaps, however, we are wrong in this. It may be that now would be a very appropriate time, so that on the resumption of shop window lighting there may not be a revival of the barbarous excesses and painful contrasts of bygone times. A further recommendation is that after the war the use of appropriate diffusing globes and reflectors designed on scientific principles should be encouraged, and that such appliances should be designed to screen the naked lights of street lamps, and to obviate the contrasts produced by alternating areas of brightness and obscurity in the roadway. But as to our contemporary. We agree with its remark as to the satisfaction it would have had to have seen some reference to the necessity of unity of control after the war. "It will," it adds, "be almost impossible to achieve any real reform in Metropolitan street lighting so long as each district goes its own way according to the whims of men who have never studied the 'A.B.C.' of illumination. The present central authority will not retain its power after the war; but it supplies a precedent which will aid a campaign in favour of establishing a competent body to supervise the methods of street illumination in relation to both safety and efficiency."

Sir Walter R. Plummer, who was Deputy-Chairman of the Newcastle-on-Tyne and Gateshead Gas Company, and who died last December, left estate of the value of £24,217; the net personalty being £22,667.

A member of the French gas industry who is numbered among the victims of the war is M. Dolizy, formerly Manager of the Commines Gas-Works. Entering the French Army at the time of mobilization, he was taken prisoner in October, 1914, and during his long period of internment in Germany suffered the extreme physical and mental privations consequent upon his transfer to a reprisal camp. News has quite recently reached France that his death took place towards the end of March.

INSTITUTION OF GAS ENGINEERS.

Annual Report of the Council, 1917-18.

In their report on the position of the Institution and the work on which it has been engaged during the past year, the Council say that, though confronted with increasing difficulties in every direction, owing to the effects of the war, the gas industry has continued to render service of the highest national importance. In this work the Institution continues to be closely identified; and appreciative acknowledgments have been received from the various Government departments concerned. In regard to the work being carried out for the Explosives Department of the Ministry of Munitions, it should at once be stated that the need for the maximum recovery of toluol and benzol is as great as ever.

Fuel Oil for the Navy.

At the request of Sir Arthur Churchman, the Controller of Munitions Mineral Oil Production, consideration was given to the question of the best means for increasing the supply of fuel oil for the navy. As a result, a meeting was held at Manchester on April 12 [*ante*, p. 132], when a scheme was put forward for obtaining a maximum quantity of fuel oil from the carbonization of cannel or coal in continuous vertical retorts, which is likely to prove of great national value. Attention is drawn to the Government offer of an award of £2000.

Coal Control.

The Institution has been called upon for assistance in various movements by the Controller of Coal Mines with the object of conserving supplies and reducing transport. Mr. Thomas Glover (Past-President) and Mr. Samuel Glover (Vice-President) are both acting as Technical Advisers.

Gas Traction Committee.

Evidence has been given on behalf of the Institution before the Gas Traction Committee of H.M. Petroleum Executive. The Committee's terms of reference and conclusions and recommendations [*ante*, p. 191] are set forth.

British Wounded in France.

Through the kindness of the President and Committee of the Société Technique de l'Industrie du Gaz en France, arrangements have been made whereby members of the French Society could visit members of the British Gas Industry who might be lying wounded in France. The Council expressed their grateful thanks for this touching mark of sympathy of their French colleagues. Members knowing of any cases of the kind indicated are asked to send particulars without delay to the Secretary of the Institution.

Membership.

The Council regret that the deaths of the following have to be recorded:

Honorary Members.—Emile Cornuault, Paris; Alfred Lass, London; Maurice Platon, Lyons.

Members.—Henry Alley, Wells; Joseph C. Angus, York; W. F. Cotton, Dublin; Arthur H. Elliott, New York; J. B. Fenwick, Retford; John Furniss, Slaithwaite; Benjamin Green, Mitcham; William Hardie, North Shields; Charles Hawksley, London; John R. Heath, Hanley; Frederick Kent, Worksop; John Miles, Bolton; Charles Pouchain, Rome; James Purves, Ayr; Fletcher W. Stevenson, Coventry; Arthur F. Thomas, Aberkenfig; J. H. Willoughby, Brownhills.

Associate Member.—Harry Shaw, Salford.

Students.—Robert Burr, Doncaster; Beresford F. Parsons, Birmingham.

The two students whose loss the Institution mourns have made the supreme sacrifice for King and country. Mr. Parsons, who had gone through some months' service in France in the 6th Warwick Territorials, afterwards joined the Royal Flying Corps, and met his death on Jan. 23, 1917, the result of an accident while flying. Mr. Burr was wounded at the Western Front on June 18, 1917, while serving with the Chemical Section of the Royal Engineers, and died the same evening. Mr. Charles Hawksley will be remembered by the Institution as the son of the first President of the British Association of Gas Managers—the late Mr. Thomas Hawksley, F.R.S.

At the close of the year 1917, the total number on the register was 873, as compared with 867 the previous year. The additions consist of seven honorary members, twenty-eight members, eight associate members, and one associate.

During the year, the following distinctions have been conferred on members: The Right Hon. Lord Moulton (President) has received the honour of the Grand Cross of the Most Excellent Order of the British Empire; Sir Dugald Clerk (honorary member), a Knighthood of that Order; Mr. W. Doig Gibb and Mr. C. C. Paterson have been appointed Officers of the Order. The Institution has been honoured also by the election of Mr. H. E. Jones (Past-President) as President of the Institution of Civil Engineers.

Accounts.

Having regard to the adverse balances, and to the estimated requirements for the future, the Council have decided to propose at the forthcoming meeting that the annual subscription be

increased to two guineas for members, and for associate members and associates to one-and-a-half guineas. As this increase cannot become operative until Jan. 1, 1919, members have been invited to make a voluntary payment of the proposed increase for the year 1918. A considerable number have already responded to the invitation.

The Council have increased the affiliation fee of District Associations to ten guineas each per annum.

Annual General Meeting.

The fifty-fourth annual general meeting of the Institution was held on Tuesday, June 5, 1917, at the Institution of Civil Engineers, London, under the presidency of Mr. A. E. Broadberry, M.Inst.C.E., Engineer and General Manager of the Tottenham District Light, Heat, and Power Company. A special meeting was held on July 5, when the alteration to Article of Association 50 (*f*) was confirmed, and the following were elected as honorary members: Dr. Frederick Mollwo Perkin, F.I.C., and Mr. D. Milne Watson, M.A., LL.B.

Demobilization Committee.

This Committee consists of Mr. R. G. Shadbolt as Chairman, and the District Members of the Council for the year 1917-18. The Committee have met twice since they were appointed, and report that they took the earliest opportunity of communicating their purpose and existence through the Technical Press, but that, up to the present time, they have had very little call made upon them.

Examinations in Gas Engineering, Supply, and Fitting.

Particulars are given as to the number of candidates for the different examinations, and as to the prize-winners. The total number of Institution certificates granted to gas-fitters is 312.

The prizes offered by the City and Guilds of London Institute in connection with the examinations of 1917 were awarded as follows: In "Gas Engineering:" M. Barash (Manchester), first prize, silver medal in Final examination; D. R. Campbell (London), first prize, Grade I., bronze medal; J. F. Lloyd (Wrexham), second prize, Grade I., bronze medal. In "Gas Supply:" J. Bradbury (Whaley Bridge), first prize, silver medal in Final examination; P. Marsland (Huddersfield), first prize, Grade I., bronze medal; J. Sparkes (Wigan), second prize, Grade I., bronze medal. In "Gas-Fitting:" W. G. Wright (Liverpool), second prize, Final examination, silver medal; W. G. Lowton (Exeter), second prize, Grade II., bronze medal. The prizes offered by the Society of British Gas Industries were announced in the "Journal" for July 17, p. 101.

Refractory Materials.

The Institution and the Society of British Gas Industries propose to again contribute £150 each for the purposes of the research; and the Privy Council Committee for Scientific and Industrial Research will, it is hoped, make a grant of £330 for 1918. Although the whole of last year's grant has not been expended, it is hoped that an additional worker may be secured, in which case the whole of the above amounts will be required.

As a result of the conference on the Organization of Refractory Materials Research, mentioned in last year's report, much correspondence has taken place on a proposed Association for Refractories Research. The Joint Refractory Materials Committee have made certain suggestions on the matter; and it is hoped that a satisfactory arrangement will be come to which will secure coordination in the various researches now in progress, or which in future may be instituted.

Gas Investigation Committee.

The Gas Investigation Committee report as follows:

The Gas Heating, Lighting, and Ventilation Research Committee of the Institution and the University of Leeds was in existence at the time of the appointment of the Gas Investigation Committee by the Institution, and was made the Research Sub-Committee for the purpose of investigating the relative efficiency in use of different grades and compositions of gas and reporting thereon to the Gas Investigation Committee. The composition of the Research Sub-Committee is: Chairman: Prof. Arthur Smithells. Representatives of the University of Leeds: Prof. J. B. Cohen, Prof. John W. Cobb, Mr. G. Thompson. Representatives of the Institution of Gas Engineers: Messrs. J. Bond, J. H. Brearley, E. W. Smith, and Chas. Wood. Mr. James W. Wood, M.Sc., was appointed Research Chemist for carrying out the work of the investigation, under the supervision of the Livesey Professor, John W. Cobb.

A preliminary period was devoted to a critical examination of methods and instruments, with a view to securing reliability throughout and saving time where possible. The experimental work was then transferred to the Nechells laboratory of the Birmingham Corporation Gas Department, where valuable facilities had been offered. It was there possible to carry out the testing of the relative merits of various gases and gas mixtures, which could be stored or mixed as desired in a graduated holder, and drawn into the laboratory for testing purposes. In the investigation so far, comparative economics have not been considered in producing gases by different methods, but in determining the relative efficiencies in use of the gases when made. These are two equally important but distinct inquiries.

Having regard to what is practicable, particularly at the present time and in the near future, the tests have all been made with what may be regarded as good representative examples of existing appliances, and with no adjustments beyond those provided by the makers, unless otherwise stated. The grades of gas so far investigated are such as are readily obtainable in gas-works practice. A survey has been made of three important domestic applications of gas—namely, the ring-burner, the incandescent mantle, and the gas-fire; but each section is yet incomplete, and requires further systematic investigation. It is to be noted that these three appliances, obviously depending as they do respectively upon total heat, total radiation, and limited (light) radiation, are well adapted for testing the ranges of usefulness a gas possesses Industrial heating and gas-engine work have not yet been touched; but valuable facilities have been offered to the Committee.

It has been agreed that the results so far obtained are of the greatest interest and value to the gas industry; and they point to a considerable elasticity being desirable in any standard which should in the near future be adopted for gas. But in order to place any recommendations and conclusions beyond criticism, it is essential as far as possible to fill in all the gaps in the series of experiments; and for this reason it is desired to postpone any publications till the necessary work is nearer completion.

A large quantity of work has been done, but considerably more will will have to be undertaken before the Committee can feel justified in making any definite recommendations. The subject is obviously of first-rate importance; and possibly it may be necessary to summon a special meeting of the Institution to consider the conclusions at which the Committee finally arrive.

The Committee wish to acknowledge their indebtedness to the Birmingham Corporation Gas Department and to Mr. E. W. Smith, the Chief Chemist of that department and a member of the Committee. They would also like to place on record their great appreciation of the patience, skill, and ingenuity which have been displayed throughout by Mr. James Wood, the Research Chemist, in carrying out this work at a time when exceptional difficulties have had to be constantly met and overcome.

Life of Gas-Meters Research Committee.

The question of the guarantee of gas-meters, which was referred to the Committee by the National Gas Council, owing to the makers having proposed to reduce the period of guarantee to two years, has been carefully considered. As a result, the Council are in a position to recommend to the National Gas Council standard clauses (as follows) for insertion in meter contracts, embodying a five years' guarantee on terms which they regard as equitable between buyer and seller.

Standard Guarantee Clauses for Gas-Meter Contracts.

As from Feb. 1, 1917, gas-meters will be sold and repaired under the following guarantee, in place of any guarantee hitherto given or implied:

1. The contractors guarantee that all precautions which are usual and reasonable have been taken to secure the best materials and workmanship available.

2. This guarantee covers continued accuracy in the registration of meters, except in so far as such accuracy of registration is interfered with by deposits from the gas or injury from exposure, violence, or fire, or persistent use of the meter at substantially above its rated capacity.

3. The contractors undertake, subject to the conditions herein contained, and provided the meters are returned to them carefully packed and carriage paid, to make good, free of charge, any defects in materials and workmanship, within five years from the date of sale.

4. In the case of meters repaired at any date beyond five years from the date of purchase, the guarantee period is for two years. But in the case of such meters the guarantee does not cover the replacement of any portion of a meter which was not replaced at the time of a previous repair.

5. During the period of the five years' guarantee, and after two years from the date of purchase, a charge will be made for cleaning and readjusting a meter which is returned to the makers, if it be found that no repairs to the meter, other than such cleaning and adjusting are necessary.

6. Apart from defects in workmanship and materials, contractors shall not be held responsible for errors of registration in new or repaired meters that have not been in actual use, unless they are notified of such errors within three months from the date of the dispatch of the meters from the works.

Note.—The method of settling questions and disputes arising out of this guarantee should be provided for in each contract.

The work of detailed investigation into the circumstances affecting the life of gas-meters, which is the principal task of the Committee, has not been proceeded with, owing to the difficulties of the times. But it is hoped that conditions may soon permit of this important investigation being resumed. It is felt that District Committees working in various centres in conjunction with gas-works would enable valuable information to be obtained bearing on the investigation in hand.

In the meantime, the Committee have taken up the questions (1) of whether the number of sizes of meters usually manufactured could be reduced with general advantage; and (2) of the rating of meters according to their capacity for maximum hourly registration without overstrain—it being felt that the present rating, on the basis of so many "lights" consuming 6 c.ft. per hour, is both obsolete and misleading.

The Birmingham Medal.

The Council have unanimously resolved that the Birmingham Medal should be awarded to Mr. John West, honorary member of the Institution; and it will be presented accordingly at the forthcoming annual meeting.

Other Work.

The report concludes with mention of what has been done in various other directions.

Conjoint Board of Scientific Societies.—The Institution has been represented on the Board for the past year by the President, the Right Hon. Lord Moulton, G.B.E.

Engineering Standards Committee.—Mr. Chas. Carpenter, D.Sc.,

and Mr. Charles Hunt, who are the representatives of the Institution on the British Engineering Standards Committee, have reported the completion of the British standard specification for cast-iron pipes and special castings for water, gas, and sewage, as finally approved by the Committee. Copies of the specification have been placed in the library, and may be obtained on application to the Secretary.

Engineering Training Organization.—Mr. A. E. Broadberry was appointed to represent the Institution in the consideration of a proposal to form a central organization for improvement in and better co-ordination of engineering training. A largely attended and representative conference on the subject was held on Oct. 25, 1917. The outcome of this was the appointment of a Committee who have formulated a scheme for the establishment of a body called the Engineering Training Organization. The Council have under consideration a request for financial assistance.

Electric Power Supply in Great Britain.—The interim report on Electric Power Supply in Great Britain presented by the Coal Conservation Sub-Committee to the Reconstruction Committee of the Ministry of Reconstruction is receiving the consideration of a Committee.

Patents and Designs Bill, 1917.—The Institution, with other technical bodies, has considered the provisions of this Bill as they affect the position of patentees whose interests have been adversely affected by the war. At a conference on the subject, it was unanimously decided that, if possible, a separate Bill should be introduced to deal with a moratorium for patents; and a Committee has been appointed for proceeding with the matter.

Canal Traffic.—The Waterways Association, in the work of which the Institution continues to interest itself, reports that the position of the Association as to any active propaganda during the past year was, of necessity, much the same as in other years since the outbreak of war. The Association believes, however, that the development of the inland waterways of the country will be one of the questions to be taken up by the Government immediately after the war.

The report which is dated May 18, is accompanied by the accounts, and is signed by the President (Lord Moulton) and the Secretary (Mr. Walter T. Dunn). It includes a list of presentations to the library.

THE BENEVOLENT FUND.

The Committee of Management of the Benevolent Fund, in their report for the year 1917-18, state that the income of the fund for the twelve months ended Dec. 31 last amounted to £446. The expenditure was £442. But for the welcome donations, there would have been a deficit of over £70.

During the year grants have been made in sixteen cases, and applications for assistance continue to be received. The Committee examine each case most carefully, and give the fullest consideration to them. But it is obvious that the extent of the grants must be limited by the resources at disposal. There are still a large number of members who do not subscribe to the fund. To them, the Committee earnestly appeal for their help to sustain this beneficent branch of the Institution's activities.

The Committee have received with regret the resignation of Mr. James Macleod, of Glasgow, and to fill the vacancy have elected Mr. Alexander Masterton, of Edinburgh. Mr. H. E. Bloor and Mr. Samuel Glover are the two members of the Committee who retire this year in order of rotation. To serve in their places, the Committee have nominated Mr. W. B. Farquhar, of Ilford, and Mr. W. W. Woodward, of Salford, for election at the forthcoming annual meeting of the contributors to the fund.

ADAPTING MECHANICAL STOKERS TO USE COKE.

[Communicated to "The Times" Engineering Supplement.]

The Order issued recently by the Board of Trade, to the effect that, south of a line drawn from the Wash to the Bristol Channel, electric lighting and tramway authorities must reduce their coal consumption by 15 p.ct., has naturally diverted the attention of power station engineers to the possibility of utilizing available substitute fuels. Among the various suggestions offered by the Tramways (Board of Trade) Committee with the view to giving effect to this Order, the partial substitution of locally produced gas coke would appear to be the only expedient which does not involve a loss in revenue corresponding to the 15 p.ct. reduction in coal supplies.

AVAILABLE SUPPLIES.

One result of the imperative need for many of the products derived from coal carbonization, together with a growing shortage in gas oil supplies, has been the accumulation of considerable stocks of surplus coke at many important centres; but before it can be utilized to the best advantage at power stations, existing coal-burning mechanical stokers must necessarily be adapted to suit the peculiar characteristics of coke. In most modern power stations mechanical stokers of the chain-grate type are used; and in view of the many practical and financial advantages that will accrue by utilizing locally produced coke in lieu of rail or seaborne coal, it may be of interest to indicate the modifications which have been found necessary in order to adapt chain-grate stokers to the use of coke.

THE CHAIN GRATE STOKER.

The chain-grate stoker is essentially a "coking" stoker, designed primarily to deal with semi-volatile bituminous coal on the well-known coking or two-stage principle. The coal is fed from a feed hopper on to a moving grate in a single layer of any desired thickness, and is carried forward under an incandescent coking or ignition arch. Here the primary stage of distillation and combustion of the hydrocarbon gases is completed; the necessary high temperature of the arch being maintained by the heat evolved, and the continuous ignition of the incoming coal ensured. In the secondary stage, the combustion of the solid residue or coked coal is timed to be completed before the rear end of the grate is reached, at which point the incombustible ash and clinker are automatically passed over dumping bars and periodically dumped into an ashpit or hopper below.

ADMIXTURES OF COAL AND COKE.

The effect of simply substituting an intimate admixture of bituminous coal and non-volatile coke as fuel for use on a stoker of this type should be, on consideration, sufficiently obvious; but many power station engineers have no doubt proved by experiment the impossibility of maintaining, even with moderate admixtures of coke, the high temperature of the coking arch which is essentially necessary to ensure continuous ignition of the fuel as it enters the furnace. With such admixtures the temperature of the arch is gradually lost, and misfiring then occurs; while the impossibility of adjusting the time factor so that both the free burning coal and the relatively slow-burning coke are completely consumed on reaching the dumping bars, should be apparent. Experience has, in fact, proved that in these circumstances the partially burnt coke accumulates at the rear end of the grate, and is finally dumped along with the ash and clinker.

A NEW FUEL BLENDING DEVICE.

With the view to relieving congestion at gas-works by promoting the use of coke as fuel for steam raising, various experiments have been instituted under the ægis of the London Coke Committee; and their Engineer and Fuel Expert (Mr. E. W. L. Nicol) has now developed an apparatus, for which a patent application has been filed, for firing coke and coal on chain-grate stokers in two or more superposed layers—a system of blending bituminous and non-bituminous fuels first used by him at an important Provincial power station. In its simplest form, this apparatus consists of a double feed hopper; the front compartment being arranged to feed on to the grate suitably graded coke in an even layer, the depth or thickness of which is proportioned to the draught available. From the second compartment of the combined feed hopper a layer of bituminous coal slack is fed; the joint thickness of the two layers being regulated by means of a guillotine door. For use with gas-coke breeze, or other non-bituminous fuel in a state of fine subdivision, which is liable to sift through the grate, a three-compartment feed hopper has been designed, the front compartment of which is used for feeding on to the grate a layer of relatively large sized fuel. This system tends to eliminate the loss due to the riddling of the small coke through the grate, and also protects the grate from the intense local heating effect common to all non-bituminous fuels.

OVERHEAD STORAGE ARRANGEMENTS.

Following upon the experimental stage of development which has been continued on one set of boilers over a period of two years, this system of firing gas coke under ordinary conditions of natural draught has now been adopted on a large scale at various tramway, railway, and other power stations. Where the quantities handled are large, the difficulty of storing and feeding both coal and coke to each boiler, or battery of boilers, has been obviated by dividing the overhead storage bunkers into two separate compartments and suitably arranging the shoots. In other cases, as a temporary measure, an overhead bunker has been isolated and used for coke exclusively from which the coke, elevated in the usual manner by means of a conveyor, is filled into steel tipping trucks, from which it is, in turn, filled into auxiliary coke feeding hoppers attached to the mechanical stokers. The proportion of coke used may, however, be in excess of that of coal, in which case it might be convenient to feed coke instead of coal by gravity to each individual boiler.

ACTUAL WORKING RESULTS.

Actual working results given by one important user tend to prove that there is not, as might be anticipated, any loss in boiler capacity due to using, by means of this system, an average of two-thirds admixture of coke. There is, in fact, a substantial

—	Coal.	Coke and Coal.
Draught, at uptake	⅛ in.	⅛ in. to ¼ in.
Fuel burnt per square foot of grate area per hour, lbs.	26	26 to 30
CO_2, per cent.	8	10 to 12·5
Excess air, per cent.	159	100 to 65
Evaporation from and at 212° Fahr. per lb. of fuel as fired, lbs.	7	7·8
Evaporation per square foot of grate area per hour, lbs.	182	202 to 234

improvement in thermal efficiency due to the unusually low excess of air used and the consequent higher proportion of CO_2 obtainable in the flue gases, as will be seen from the comparative figures, which are based upon (1) average results obtained with coal exclusively, and (2) results obtained with two-thirds coke and one-third coal slack:

IMPORTATION OF PYRITES FOR SULPHURIC ACID MAKING.

By "Cricket."

There is an abundant supply of sulphuric acid according to recent announcements—in fact, I hear that many manufacturers have been requested to diminish the output of their works. This is a very healthy state of affairs for which sincere congratulations have been merited by the Government Department specially concerned.

This renders it no longer necessary to import pyrites, as the whole of the sulphuric acid required can be made from home-made spent oxide, of which large quantities, due to the import of pyrites, are being accumulated at several works. The matter is receiving official attention, it is understood; but official attention has a way of hanging in the breach, unless impelled forward by the Press. But, curiously enough, ships are still being employed to bring pyrites to these shores.

As there is always some doubt that the Government Departments do not exchange information readily enough, I suggest that, rather than ships still continuing to travel long voyages for the purpose of collecting pyrites, it would be better to employ the vessels on short voyages between the North-East Coast and the South of England carrying coals, preferably to gas-works, where coal is converted into products of the very highest importance for the successful prosecution of the war. No other industries are able in any way to approach the vital utility of gas-works and coke-oven works especially when so small a percentage (about 18) of all home-consumed coal is responsible for such vitally necessary products. In this way, ships would be able to perform six or seven voyages to the present one.

It must be remembered, too, that when pyrites is manufactured into sulphuric acid, there is a considerable quantity of waste material to be dealt with, that is of very little use. On the other hand, spent oxide after use for sulphuric acid manufacture is reconverted into active oxide for further use as a purifying agent at gas-works. A matter of great importance is that there is insufficient oxide to meet the demand. The object of this article is to point a way of easily overcoming the difficulty.

Pyrites acid is arsenical, and is for many purposes not so useful as non-arsenical acid manufactured from spent oxide. Objection may be taken by pyrites acid makers that their furnaces are not suitable for burning spent oxide. If one places the value of the pyrites furnaces against the value of ships and freightage, the only thing to be said is that it may be possible in most instances for the pyrites acid manufacturers to build spent-oxide furnaces, which, after all, can be erected at comparatively small cost; and, to overcome their scruples, the Ministry of Shipping should offer to defray the expenses.

In those cases where the acid works are so crowded that there is no room to erect separate spent oxide furnaces (these must be very exceptional cases), it might be necessary to demolish some of the pyrites furnaces, and erect spent oxide furnaces in their place. In fact, a large part of the pyrites burners can be utilized for spent oxide burning. Acid manufacturers will recognize that if they have sets of burners capable of burning both spent oxide and pyrites, it will be much to their advantage. Another point of great consideration is that the cost of freightage on the pyrites is assisting at the present moment to make acid very dear.

If, therefore, better acid is made entirely out of home-produced spent oxide, the relative price of sulphuric acid should be less, and better acid should be supplied.

Burnt oxide supplies for gas purification are getting very short on account of the accumulation of spent oxide at acid works. The elimination of the imported pyrites will, therefore, cause the spent oxide to be converted into burnt oxide, and make readily accessible a supply of burnt oxide, which is urgently needed at gas-works.

The best advice I can give to gas-works generally in regard to burnt oxide for use in purifiers, is that, when selling spent oxide and buying burnt oxide, for every ton of spent oxide sold they should demand in exchange an equivalent of burnt residue for the purpose of making prepared burnt oxide for use in the purifiers. Will the respective Ministries of Shipping and Munitions kindly make a note?

Brighton and Hove Gas Company Fined.—On Friday, the Magistrates dealt with seventeen summonses against the Brighton and Hove Gas Company for supplying gas of a calorific power of less than 500 B.Th.U., on dates between March 15 and April 24. After a full hearing [a report of which is held over until next week], the Justices imposed penalties of £5 on each summons, with £52 10s. costs—in all £137 10s.

REFRACTORY MATERIALS IN BRITAIN.

The Fourth Meeting of the Refractory Materials Section of the Ceramic Society was held at Sheffield University last Tuesday and Wednesday—the President, Mr. W. J. Jones (Deputy-Controller of Iron and Steel Production, Ministry of Munitions), occupying the chair. There was a very large attendance of members from various parts of the kingdom. After the Vice-Chancellor (Dr. Ripper) had welcomed the visitors.

Prof. W. G. Fearnsides (Sheffield) gave an account of the ganisters, fire-clays, and other refractory materials known to be available in the Sheffield district, and Mr. J. Holland (Sheffield) contributed notes on the evolution of the ganister industry in the Sheffield district. Dr. A. Scott (Glasgow) followed with a paper on the "Constitution of Silica Bricks" and a brief account of a "Micro-Study of Magnesite Bricks." Mr. Alleyne Reynolds then dealt with the "Essential Properties of Refractories Used in Steel Production," which concluded the morning session.

In the afternoon's programme were a paper by Mr. E. Steiger, entitled an "Advance towards Greater Economy of Fuel and Increased Output in the Deadburning of Magnesite and Dolomite and the Burning of Cement," and two papers by the eminent Frenchman, Dr. A. Bigot—one on "Silica Products," and the other on "Refractory Materials Derived from Bauxite (Fused and Crystalline)." The next contribution related to the "Dissociation of Salt," by Mr. H. V. Thompson; and the final one for the day was by Mr. J. P. Leather, of Burnley, on "Refractories in Gas-Works from a User's Point of View." The text of this paper is given on p. 333.

The first (and most important) item in the second day's proceedings was the report, presented by Dr. J. W. Mellor, of the Special Committee on the "Standardization of Tests for Refractory Materials (Part I.)," in which the importance is pointed out of standardizing the mode of conducting the tests, so as to reduce to the narrowest limits variations in results due to peculiarities in methods of testing. Details are then set out for—

(1) Analysis of fire-clays, raw ganisters, quartzoze rocks, and manufactured products. Instructions are given for the determination of hygroscopic moisture, loss on ignition, silica, alumina, ferric oxide, titanic oxide, lime, magnesia, and alkalies.
(2) Analysis of dolomite and magnesite. Hygroscopic moisture, alkalies, ferric oxide, and titanic oxide are to be determined exactly as in clays, &c. But for other determinations certain slight modifications are necessary; and in addition phosphorus and sulphur have to be determined.
(3) The identification of the various forms of silica in silica bricks. This well deserves the attention of those specially interested.
(4) Porosity, water absorption, and specific gravity tests. Approved methods are described briefly, but in sufficient detail.
(5) Shrinkage of clays on drying and firing. Suitable modes of procedure are described, the shape and size of the test pieces being shown by figures.
(6) Tensile strength of dried clays. The testing machine is illustrated, as is the shape of the piece to be tested; and a third illustration indicates the mode of conducting the operation.
(7) After-contraction or after-expansion of refractory materials. The method of conducting the test is briefly described.
(8) Normal refractoriness of fire-bricks, fire-clays, &c. The method of determination by heating a prepared test-piece along with a series of cones is described and illustrated. A table is appended showing the approximate squatting or softening temperatures [often termed melting-points] of Seger cones.
(9) Refractory test under load. This is an illustrated description of a test designed to ascertain the probable behaviour of material under working conditions.
(10) Thermal or reversible expansion of refractories. An illustrated description of a method for determining hot and cold sizes of fire-bricks.
(11) Crushing strength—cold. This is an illustrated description of a method for determining the crushing pressure [in pounds per square inch].

Discussion took place on these proposals, which met with general approval, though it was suggested that in some cases alternative tests would be better suited for works laboratories.

In connection with Mr. Leather's and Mr. Thompson's papers, Mr. J. W. Lee pointed out an important difference between gas-works practice and coking practice, in that salty coal gave little trouble in the former, while in the latter the refractory material suffered considerable damage. A subsequent speaker referred to the great differences of temperature—the range varied as much as 50 p.ct. in a particular case, on specified occasions—in coke-ovens, and the damaging effect of such variations on the brickwork.

Canadian Gas Association.—Mr. George W. Allen, the Secretary-Treasurer of the Canadian Gas Association, intimates that the eleventh annual convention will be held in Montreal on Thursday and Friday, Aug. 22 and 23, under the presidency of Mr. J. M. H. Young, of London, Ontario.

THE CHEMISTRY OF COAL.

Further Researches on Exhaust Tar.

Prof. Aimé Pictet, whose work with his students on the investigation of the substances actually present in coal have formed of late years a notable series of contributions to this subject,* has recently published the results of some further experiments on the tar produced by the distillation of coal under greatly reduced pressures.

It may be remembered that in the earlier paper just cited Prof. Pictet dealt with the hydrocarbons contained in this exhaust tar, and showed that they form a series of compounds practically identical with those existing in certain petroleums. In the latest paper, published in the "Journal des Usines à Gaz" for April 20, he describes the identification of certain alcohols and bases in the tar. The alcohols are present to the extent of about 2 p.ct., and the basic nitrogen compounds to about 0 2 p.ct. These substances are readily separated from the hydrocarbons which make up the rest of the tar. The bases are extracted with dilute hydrochloric acid. The alcohols are obtained by then boiling the liquid with sodium, which forms a deposit of solid alcoholates with evolution of hydrogen. The hydrocarbons are removed by decantation and by heating in a vacuum, after which the addition of cold water produces an alkaline solution on which float the liberated alcohols. They are freed from the last traces of hydrocarbon by a second treatment with sodium, and finally separated from each other by fractional distillation.

The mixture of the basic compounds has likewise been fractionally distilled and addition made to each of the principal fractions of an alcoholic solution of picric acid. In this way, sparingly soluble picrates are formed which are purified by crystallization in alcohol until a constant melting point is obtained. The corresponding base can then be isolated by means of soda.

As a result of this method of examination, the bodies itemized in the following table have been prepared, and may be regarded as a series of definite compounds. The small quantity in which they have been obtained has not permitted (except in the case of one of them) of their composition and chemical characteristics being determined; but further work upon them is in progress.

Alcohols.			Bases.		
Formula.	Boiling Point °C.	Boiling Point of Acetate °C.	Formula.	Boiling Point °C.	Melting Point of Picrate °C.
$C_7H_{14}O$	170–175	..	C_7H_9N	198–203	170
$C_8H_{10}O$	185–190	..	C_8H_7N	225	195
$C_9H_{12}O$	198–200	213–215	C_9H_9N	247–250	184
$C_{10}H_{14}O$	213–215	226–229	$C_{10}H_{11}N$	250–260	184
$C_{11}H_{16}O$	226–228	240–244	$C_{11}H_{13}N$	260–265	173
..	..	..	$C_{12}H_{15}N$	270–280	166

The two divisions of the table exhibit an interesting parallelism. Each series of substances commences with a body containing seven atoms of carbon, which, by its composition and properties, is sharply marked from those which follow, and which present great analogies among themselves; forming two analogous series of the general formula $C_nH_{2n-6}O$ for the alcohols and $C_nH_{2n-9}N$ for the bases. The first alcohol $C_7H_{14}O$ is the only one of which it has been possible to fix the constitution. It is para-methyl-cyclo-hexanol (hexa-hydro-para-cresol). The substance from the tar has proved identical in its properties and compounds with the synthetic substance. It is unaffected by permanganate in the cold, and is a saturated and stable body.

On the other hand, the other alcohols present the peculiarity of changing spontaneously, and at a fairly rapid rate, into phenols. When freshly prepared they are insoluble in alkali, but become gradually soluble. The solution becomes turbid on passing a current of carbon dioxide, and precipitates oily substances of phenolic smell and properties. This transformation into phenols takes place in an atmosphere of carbon dioxide, although less rapidly than in air. It is hastened by heat. For example, the alcohol ($C_{10}H_{14}O$) is converted to the extent of one-third of its weight on leaving it at the ordinary temperature in a closed vessel for a month, and to the extent of half its weight by maintaining it at the boiling heat for 14 hours exposed to the air. Moreover, each alcohol appears to give rise at the same time to several phenols. It does not seem to be a case of simple transformation into a body of different constitution, but a more complex phenomenon the cause of which has still to be investigated. But the change shows that the alcohols of exhaust tar, like the corresponding hydrocarbons, belong to the hydro-aromatic series.

The alcohols containing from 8 to 11 atoms of carbon are non-saturated bodies. Their acetic ethers (readily prepared with acetyl chloride) are instantly decolorized by permanganate in cold sulphuric acid solution. These others are colourless liquids, volatilizing without decomposition and of agreeable odour.

The bases of the exhaust tar differ among themselves in the same manner as the alcohols. The lowest fraction (that passing over from 198 to 203) yields analysis corresponding exactly with the formula C_7H_9N. It possesses all the characteristic properties of the primary aromatic amines. By conversion into the diazo compound and by combination with β-naphthol it yields a fine red colouring matter. The picrate, which is easily soluble in alcohol, has a melting point of 170°; and it would thus seem that this fraction consists of a mixture of toluidines which, however, it has so far been impossible to separate.

The other bases, on the contrary, are non-saturated bodies, colourless liquids insoluble in water, and of odour resembling that of quinoline and its homologues. The picrates formed from them are sparingly soluble in alcohol.

From these experiments it is concluded that the alcohols of exhaust tar exist as such in the coal. The extract of the coal with benzene contains alcohol in an almost identical proportion; and although they have not been thoroughly studied, they resemble those from the exhaust tar as regards boiling point and rapid transformation into phenol. On the other hand, the bases, it is concluded, do not exist as such in the coal. Although the extract of the coal contains substances of basic character, these latter are different from those in the tar, and some of them are solid substances. It is to be supposed that these "fossil alkaloids" are not volatile without decomposition, even under reduced pressure, and that the bases present in the exhaust tar are the products of their decomposition.

* See "JOURNAL," Vol. CXXXVIII., p. 192.

REFRACTORY MATERIALS IN GAS-WORKS, FROM A USER'S POINT OF VIEW.

By JOHN P. LEATHER, of Burnley.

[A Paper read before the Ceramic Society, May 15.]

In a gas-works, profits are said to be made or lost in the retort-house; and the central point in the retort-house is the retort-bench, constructed of refractory materials. On the proper quality, disposition, and use of these materials largely hangs the success of the whole operations of a gas undertaking.

The main structure and walls, the producer, the regenerator, the combustion chamber, and finally the retorts themselves might each be separately considered. I propose, however, to deal first with certain primary characteristics required in all these situations, and afterwards to refer to other properties desirable in special positions.

RESISTANCE TO PRESSURE.

As to capacity to resist deformation by the pressure of the superstructure when exposed to an elevated temperature. It is not sufficient to speak of the temperature of fusion or softening. Any test of fusibility ought to be accompanied by a deforming force; and in this again the time should be taken into account. The testing of fire-brick as at present carried out attempts to discount the effect of time and pressure by requiring the material to stand for a short time, and with very little deforming force, a much higher temperature than appears in practice. The argument apparently is this: A gas-retort, which sustains for a lengthy period the stress of actual work at a temperature of (say) 900° C., gives way in a short time with a very small stress at a higher temperature of (say) 1400° C. Therefore, if a material does not show signs of fusion in a short test at (say) 1700° C., it will probably stand indefinitely in actual work. This argument may have a certain amount of truth in it, but it is not entirely convincing unless actual experience or experiment discloses some definite relation between these various elements of temperature, time, and stress. Thus, if we seek to improve and progress in our methods, we are driven on the old way of using one material, and if it fails trying something else. Failures are, however, so expensive that we prefer to keep to old tried materials, and leave someone else to experiment. This is inimical to progress.

In the combustion chamber, the bricks have to stand a temperature of at least 1500° C. It would be better if we could rely on them not yielding at even 1600° or 1650°C., as in order to have a sufficiently high temperature at every point, some parts must be considerably hotter. Often heats have to be checked for no other reason than the fear of damage to the brickwork. In many settings the walls of the combustion chamber support the upper tiers of retorts; and it is possible that in places the weight may exceed one ton per square foot. It requires a high quality of silica brick to maintain this stress for an indefinite period at 1500° C.

Here I would note that there is a great difference between a brick wall heated on both sides to the same temperature and one which is at a high temperature on one side and a low temperature on the other. In the latter case, only part of the brick is at the high temperature, and a much higher temperature can be withstood without yielding.

SIZE OF MATERIAL.

Secondly, it is important that the size of the material should not alter otherwise than by the unavoidable dilatation with heat, and the subsequent resumption of the original size when cooled. The liability of refractory materials to permanent change of size, either by expansion or contraction, is very inconvenient, and particularly so in vertical retort settings. As some parts of the setting are necessarily at a much higher temperature than others, irregular expansion or contraction leads to cracked or leaky

retorts, and in the generator to the bye-passing of secondary air, with resultant losses difficult to remedy and costly in their effect. Whether this defect is to be obviated by increased temperature in the manufacturer's kiln, or by the different choice of materials, the need of eliminating change of size in use is imperative. It must be remembered that a contraction of 0·5 p.ct. in a 25-foot retort amounts to 1·5 in.

Chemical Action.

The third desideratum is a material which will be less affected by the chemical action of dust, slag, and reducing atmosphere. If a material could be found to resist these influences at a high temperature it would be very convenient and advantageous to the gas-works manager. But, though I am here in the *rôle* of a user, I feel this claim may be pressed unduly. The brick manufacturer may, I believe, rightly reply that it is the duty of the user to avoid in his furnaces the production of slag, and so arrange that dust does not come into contact with bricks at a high temperature. With regard to reducing atmosphere, apart from the inside of the retort, the chief reducing agent is carbon monoxide. Research on this matter is not complete; but from my experience I am inclined to think that carbon monoxide has not a great effect on refractory material in the absence of dust—*i.e.*, in the absence of excessive quantities of oxide of iron and like substances. I do not think that a user ought to ask the manufacturer to provide a brick with special qualities to overcome difficulties which may be avoided by the method of working. It is a well-known fact that there is little or no direct chemical action between two solid substances. In order to bring about such mutual action it is necessary either to introduce a liquid which has a solvent action on one or both substances, or else to raise the temperature until one of the substances begins to fuse. Dust has little effect on fire-brick if the temperature does not approach its melting point.

If flue passages are of sufficiently large dimensions to avoid a cutting draught, a minimum of dust goes forward into the parts of the setting where the temperature is high. In the producer, dust is unavoidable. It is not in the producer, however, that we require heat, but in the retorts. The temperature in the producer should be kept so low that the ash does not melt. This may be brought about either by the use of sufficient steam, or, as I believe was first proposed by Siemens, by introducing waste gases into the producer with the primary air. Inside the retort the atmosphere is much more strongly reducing than in the furnace or flues, and I have yet to see evidence of the inside of the retort melting under its influence.

Crushing Stress.

I have already referred to the crushing stress which fire-bricks should be able to stand. This is seldom as high as 2 tons per square foot, and is therefore much less than ordinary red bricks are regularly subject to. Such a stress is not important except when combined with elevated temperature. Mechanical strength of another kind is, however, called for in the producer. Here it is not always possible to avoid all formation of slag, which melts and corrodes the surfaces of the bricks. The slag runs down until it reaches a part where the temperature is lower; and then it clings to the brickwork, and has to be removed by the process of clinkering. The material should, therefore, have great tenacity.

Conductivity.

In the regenerator and in the walls of the retorts greater thermal conductivity would be desirable if it could be obtained without contervailing disadvantage. It would, however, be necessary to guard against uneven expansion if the high conductivity bricks had a different coefficient of dilatation from the other bricks used in the structure. Such uneven expansion might lead to cracks or open joints through which air could pass and neutralize the whole value of recuperation.

Porosity.

In the intermittently charged retort, the sudden introduction of cold coal into the retort previously raised to its maximum temperature introduces a condition which, if the material is too dense, is liable to cause cracks. To secure that the retort shall not crack with sudden change of temperature, our standard specification demands a certain porosity. Possibly this diminishes conductivity; but of two evils a leaky retort is worse than low conductivity.

In Conclusion.

To recapitulate. The chief requirement in a fire-brick used in a retort setting is that it should not alter in size or shape under the combined influence of pressure and high temperature; and for some purposes the desiderata are better conductivity and the maintenance of integrity under certain changes of temperature.

Fire-bricks are also used in gas-works for carburetted water-gas plants. The chequer work of superheaters or fixing chambers are subject to the action of oil vapour at a varying temperature of from 650° to 800° C. Some bricks appear liable to disintegration under these conditions—probably due to their imperfect burning in manufacture.

Lastly, I might draw attention to the desirability of regular size and accuracy of shape in fire-bricks and blocks. Probably this is largely a question of securing an even and sufficient temperature in the kiln, though possibly sometimes not sufficient care is taken in the preparation of the clay before moulding. These points I leave with manufacturers, with the hope that they will not be content to remain on the lines of their forefathers, but ever seek to progress.

WOMEN'S WORK IN ENGINEERING.

The subject of women workers in engineering factories was dealt with by Mr. B. H. Morgan, in a paper which he read at the last meeting of the Institution of Mechanical Engineers; the reasons which had brought this about being explained.

There were, of course, many difficulties in the first place to be overcome; and Mr. Morgan declared that only those who, like himself, have dealt with hundreds of firms on this matter, can realize what an important part deep-rooted patriotism, on the side of both employers and workmen, played in effecting the introduction of female labour in engineering munition industries. There is, he went on, no doubt that war experience with women in engineering works has entirely destroyed all preconceived ideas as to what constituted "skilled work." Previous to the outbreak of the war, fully-skilled men were regularly employed on work which can now be performed by women after a few weeks' training. It is not that the woman is a skilled worker; but she has been put to do a job which is a subdivision of skilled work on which a fully-skilled man was previously employed. The assumption often made, that women become fully-skilled workers in a few weeks, is quite a false one. In the author's opinion, neither a man nor a woman can become a fully-skilled fitter or turner under a period of (say) four years. On the other hand, war conditions have enabled women to acquire a measure of skill in a far quicker time than men have ever previously acquired it. Women have generally been found to be accurate and conscientious workers. They acquire a high degree of accuracy quicker than men, through possessing a finer sense of touch. It has also been demonstrated that they are highly responsible workers. In regard to output, women workers have enormously increased the records of output of all products of a repetition character which were current in munition firms previous to the war; but on non-repetition work, it is doubtful whether they have, generally speaking, equalled the output of men. It is an important point, in the employment of women operatives in engineering work, that they should be managed as far as practicable by women.

The question of dilution in its different aspects was considered; and the author advocated the standardization of methods of manufacture. He also suggested the setting-up by the Institution of a Committee to study and report on the best methods, in each engineering industry, of introducing women into works, &c. In an appendix, a summary was given of work on which women are now employed, and which was carried out wholly or partially by males before the war. This makes interesting reading, and affords proof of the ample scope there is for the profitable use of female labour in the engineering industry.

Removing Oxide from Purifiers.

With the object of providing a quicker, safer, and more economical method of emptying and re-charging gas purifier-boxes, Mr. Charles H. Clower, Engineer of the Cruse-Kemper Company, of Ambler (Pa.), has designed an arrangement which enables emptying and re-charging to be a one-man operation. The oxide is held in containers, which are removed bodily from the purifier-boxes; special means being provided for taking out the container of foul oxide and substituting for it a container of fresh oxide. The unit is then set in operation again in a small fraction of the time ordinarily required. Extra containers are furnished for this purpose. They are of angle frames, with wire-mesh covering, and are collapsible. After a fouled container has been removed from the box, the mass may be spread around for revivification in the usual manner; and after the oxide has revivified, it can be replaced in a container in the open at leisure, and held in readiness for another recharge. A number of advantages are claimed for the system; among them being that the boxes (or casings) may be made of thinner steel, because of the absence of concentrated loads from tray beams. In operation, the gas enters the casing, spreading all round outside the oxide container, the shell of which, as already remarked, is wire mesh; and with the pressure behind it, it must force its way through the oxide in order to reach the wire mesh receptacle in the interior of the bed, from which it enters the outlet duct. Special connections are provided, which permit of the oxide container being easily drawn out of the casing on tracks brought up to the door, which register with permanent tracks inside the casing, on which the wheels of the oxide container always rest when the container is in position. The removal is effected by means of a hand-winch or other suitable means.

Tar Oils as Fuel.—A Special Sub-Committee reported to a recent meeting of the Association of Tar Distillers the establishment, on principle, after strenuous and prolonged negotiations, of an arrangement with the Ministry of Munitions for supplying from the tar trade as a whole the fuel oil, including pitch and creosote mixture and Diesel oil, to meet the national needs. Resolutions unanimously approving the scheme and arranging the machinery for carrying it out were adopted. It was considered that the adherence of all tar distillers should be given to the scheme; and it was stated that the Ministry of Munitions had expressed a wish to deal with the trade as one body in this matter.

WOOD, PEAT, &c., IN GAS MAKING.

Italian Experience of their Small Economic Possibilities.

An order of the Italian Controller of National Fuels at the end of last year, to the effect that the use of coal for gas making was to be prohibited and works allowed to use only wood, lignite, peat, and the like, plainly represents the acuteness of the coal question in allied countries on the Continent. While information is lacking of the extent to which the Order has been put into effect, the uneconomy of the proposed measure has been the subject of a report by two Italian members of the Société Technique du Gaz. Signors Pacchioni and Böhm have had the opportunity—as they certainly have been under the necessity—of examining the results of efforts to use substitutes for coal in retorts on a considerable scale in Italian works; and therefore their report, if it does not raise points not previously recognized, may be accepted as a well-founded judgment of the very small possibilities in the employment of wood, peat, or similar material even in a country where conditions are largely favourable.

One of the most serious objections to the distillation of material of a woody nature is the acid character of the liquors which are produced, and the consequent corrosion of plant which is designed for dealing with alkaline liquors. No less serious is the greatly inferior yield of gas and the production of bye-products which cannot be recovered. The temperature at which it is necessary to distil in order to obtain an adequate yield of gas is destructive of the very substances which in the ordinary way are profitably recovered in the distillation of wood. Analysis of liquors and tars obtained in an Italian works which has distilled wood for a considerable time has shown the presence of crude acetic acid to the extent of from 0·28 to 0·31 p.ct. in the liquors, from which, moreover, methyl alcohol (wood spirit) and acetone were absent. The tar, on the other hand, when all possible treatment had been applied to it, still contained 25 p.ct. of slightly acid water, but a very small proportion indeed of the light oils of importance in the manufacture of explosives.

Yet, putting aside these drawbacks, the quality of the gas itself is bad in all respects. Its content of carbolic acid to the extent of 25 to 30 p.ct. renders purification impossible under conditions where 1 kilo of lime is required per cubic metre of gas (= 6¼ lbs. per 1000 c.ft.), representing a cost of from 2s. 3d. to 4s. 6d. per 1000 c.ft. The high density and very low calorific power of the gas, moreover, render it unsuitable for combustion in ordinary heating appliances. A further obstacle under manufacturing conditions is the much greater number of retort-benches which it is necessary to keep in operation for the production of the same quantity of gas.

A further consideration is the light porous nature of the charcoal obtained from wood, involving the employment of large extinguishing chambers and yet failing to provide a supply of fuel sufficient for the retort furnaces, and likewise of doubtful value for use in gas producers.

These technical and economic features are sufficient to condemn the distillation of wood for gas-making purposes, and the demands upon transport militate equally against its employment. For the conveyance of the large quantities of wood which are required, five times as many wagons are necessary as for the quantity of coal yielding an equivalent number of calories; and this without regard to the fact of the proportion of water contained in the wood which represents a considerable useless weight to be transported, and is to this extent an injury to the national economy, apart from the harm in the future which may be done by extensive deforestation.

A great part of these drawbacks could be avoided if the course were adopted of distilling a mixture of coal and wood, since this plan would assure a better yield of a good quality of gas, the ammonia from the coal would neutralize the acid from the wood, and the production of coke, while sufficing for the heating of furnaces, would still leave a certain surplus of fuel for local use. Experience in several Italian works has shown that the proportion of coal should be at least 35 to 40 p.ct. Inasmuch as the Italian gas-works distil altogether 80,000 tonnes per month, and that the ten largest works, distilling coal exclusively, require about 35,000 tonnes, the plan suggested would reduce this latter quantity to 16,000 tonnes, would reduce importations, and at the same time would contribute to the requirements for munitions.

The two French reporters point out the advantage of reducing imports of steam coal and of increasing those of gas coal—an adjustment which would allow of much steam coal being replaced by coke from the gas-works. They lay stress upon the national economy which would result from distilling all the imported coal as against wasting much of it by combustion in furnaces of a primitive type; and they urge the importance of such a rational utilization of fuels. Their general conclusion from the facts which they have investigated—it applies equally to wood, lignite, peat, and waste material from olives—is that, in view of all the difficulties in the exclusive use of these materials, there is good ground for the declaration that, failing a supply of coal in the minimum proportion of 35 to 40 p.ct., it would be in the national interest to suspend the operation of the gas-works.

Mr. Charles Hawksley, M.Inst.C.E., left estate of the gross value of £192,675. He bequeathed £3000 to the Institution of Civil Engineers for scholarships or prizes.

SYNTHETIC AMMONIA.

The Haber and Preceding Processes.

At the inaugural meeting recently held in Paris of the French Society of Industrial Chemistry, Prof. Haller read a paper in which he traced the stages in the genesis of the Haber process, by which Germany is providing herself with fertilizer and materials for explosives on an enormous scale, by the synthetic production of ammonia from nitrogen and hydrogen.

When Haber, in 1905, with a student Van Ordt, investigated the quantity of ammonia formed at a given temperature, he was dealing quantitatively with a reaction which had been noticed a year previously by the English chemist Perman. He found that under the best conditions (at 1020° C.) the gases yielded a proportion of ammonia slightly greater than 1 in 10,000. His results were disputed on theoretical grounds by Nernst, who calculated the temperature for this yield as 620° C. Nernst's deductions proved to be quite fallacious; but his subsequent experiments, published in 1907, on the carrying out of the operation under pressures ranging from 50 to 70 atmospheres, yielded such small quantities of ammonia as to lead him to discountenance the process on the laboratory scale, and still more so in its industrial application.

Haber's further work was done in collaboration with an English student, Le Rossignol, who, Prof. Haller states, suggested to Haber the possibility of the industrial synthesis of ammonia, and convinced both him and the Badische Company, with the result that the Company took up the investigation of the process, supplied Haber with chemists and with part of the grant of about £2000 for the prosecution of his researches. Prof. Haller visited Haber at this time, and saw the full equipment at his disposal for working under pressure, at constant and also at low temperatures and with various catalytic agents.

The experiments then passed into the hands of two of the Badische chemists, Bosch and Mittasch, by whom they were transformed into an industrial process. The first factory established at Oppau, near Ludwigshaven, in 1913, had an annual capacity of 30,000 tonnes of sulphate of ammonia. The hydrogen for the process was prepared by the method of Linde, Franck, and Caro. In the following year, some months before the war, the capital of the Badische, Bayer, and Berlin Anilin Companies was increased by a sum (altogether) of about 108 million francs for the purpose of putting-down a new joint factory capable of producing 100,000 tonnes of sulphate per annum. This factory was not working at the time of mobilization; for the Germans, by their accumulation of explosives in 1913 and 1914, undoubtedly believed they held sufficient stock for the period of the short war which was to bring them victory. After the battle of the Marne, by which their plans were upset—that is to say, in September, 1914—producers, importers, and consumers of nitrate and chemical manufacturers were called together by the Ministry of Agriculture for the purpose of dealing with the greater production of artificial nitrate. A sum of 30 million marks was then placed at the disposal of the Badische and Bayer Companies for the laying down of factories for the conversion of ammonia into nitric acid, and a programme drawn up for the synthetic production of nitrate substances. According to this plan, 500,000 tons of sulphate of ammonia were to be yielded by the Haber process, making, with 500,000 tonnes of cyanamide, a total of 200,000 tonnes combined nitrogen. This programme, drafted at the end of 1914 or the beginning of 1915, is probably almost completely realized at the present time.

Apart from the production of the Badische, Bayer, and Anilin factories, the synthetic manufacture of ammonia is not on a large scale. The Griesheim works and those of the German Welsbach Company, of which latter Haber is Consulting Engineer, make only a comparatively small amount.

But perhaps the most interesting part of Prof. Haller's paper is that in which, turning from the present achievements of the German chemists, he makes public his inquiry into the past patent literature of the subject, and cites specifications the details in which, so he believes, are sufficient seriously to compromise the validity of the patents by virtue of which the Badische Company claims a world monopoly of its process. These citations, greatly abridged from the text of the paper, are as follows.

An English patent (No. 1833 of 1865), taken by Dufresne, in the name of Charles Tellier, mentions the production of ammonia by the direct combination of hydrogen and nitrogen through the medium of spongy iron, as a bye-reaction in the manufacture of oxygen.

In 1871, a French patent (No. 92,346), of Tessié du Motay, was taken out for the synthetic production of ammonia by the alternate passing of hydrogen and nitrogen over heated titanium nitrides. A further French patent of Charles Tellier (No. 138,472 of 1881) claimed the manufacture of ammonia by a similar process, using spongy iron. The process is the subject also of a German patent, No. 17,070 of 1881, taken out by the Nitrogen Company of Paris, which was established by Tellier, in which one claim relates to the employment of the hydrogen and nitrogen gases under pressure of the order of 10 atmospheres.

The production of small quantities of ammonia on the passage of a nitrogen-hydrogen mixture over heated iron wire was noted by Ramsay and Young in 1884; and a mixture of the two gases in

conjunction with a catalytic agent of titanium in admixture with finely divided platinum was the subject of an Austrian patent (No. 45/2938 of 1895) taken out by Hlavati.

The most important anticipation of the process, however, is that contained in a French patent (No. 255,183) of the Société Christiania Minekompani, for the production of ammonia by the passing of a mixture of nitrogen and hydrogen through a heated chamber containing finely-divided titanium deposited on inert material. This patent lays particular stress on the very great range of metallic substances which can bring about the synthesis of ammonia from the gases. It is mentioned that almost all the metals or their carbides can play this part, though with unequal effectiveness. The essential condition is that the metal should be in an extremely fine state of division, or deposited on an inert substance, and that the temperature should not exceed a point at which the ammoniacal compounds decompose. At the same time, a proper choice of two or more metals will yield results which are better than those with a single metal. It is worthy of note (comments M. Haller) that all the metals, carbides, mixtures of two or more metals, and the employment of an inert support for them appear in the subsequent patents of the Badische Company. To bring to an end the documents which in greater or less measure anticipates the Haber process, there is the French patent (No. 313,950 of 1901), taken out by M. Le Chatelier, for the direct production of ammonia from hydrogen and nitrogen under pressures up to 100 atmospheres, and with the use of catalytic agents; also the note of Perman, that iron, copper, zinc, palladium, and other metals intensify the reaction, and that pressure contributes to it.

M. Haller concludes that the immense importance of cheap combined nitrogen in augmenting the yields of crops, and thereby lowering the cost of living, should stimulate both Governments and industrial concerns to defend their interests against the application of a monopoly which threatens them in the future. His conclusion from the documents quoted is that in the scientific sphere, as in that of others, the Teutonic mind is true to its tradition of appropriating the property of other people.

LIGHT AND VISION.

By Professor W. M. Bayliss, F.R.S.

[Extracts from a Paper read before the Illuminating Engineering Society, April Meeting.]

A large part of the paper was devoted to the consideration of the processes which occur in the retina of the eye on the incidence of light. Later the author dealt with the question of

Light and Contrast.

In this connection, he said: From the physiological standpoint, there can be no doubt that the contrast should not be too great, owing to the unpleasant and injurious effect of a sudden illumination of a spot on the retina rendered sensitive by previous comparative darkness. Any very intense stimulation of a nerve of special sense is more or less painful, and therefore injurious, since pain is, as a rule, a protective warning. It is difficult to state exactly what occurs on the retina when the unpleasant sensation resulting from exposure of the eye to excessive contrasts is experienced; but it is a fact that when very intense and prolonged exposure takes place, detectable damage to the cell structures can be made out. The presumption is that any glaring conditions which cause discomfort are prejudicial. In mild cases of glare the discomfort is merely temporary; and the great recuperative power of the eye may prevent appreciable injury. But it might well be that if the eye was habitually subjected to glare this would have the effect of hastening failing sight in later years, even though no apparent ill-effects were to be experienced at the time. The difficulty of imposing definite limits to glare arises (1) from the varying resisting and recuperative powers of different eyes; and (2) because the eye, at any moment, is affected differently by a light of given brightness according to its state of adaptation.

The effect of adaptation in altering the "glare-limit" was brought out in some interesting experiments by Mr. P. G. Nutting, who measured the brightness of a small area when made just painful to the eye in different states of adaptation. Mr. Nutting's experiments afford some support for the suggestion that the ratio of brightness of objects in the field of view should not exceed 100 : 1. While it would be premature to say that a physiological basis for this suggestion is established, it seems quite a reasonable figure to take; and there is every reason to support the general principle on which illuminating engineers lay stress, that no unshaded bright sources, such as filaments or incandescent mantles, should be allowed to fall within the direct range of vision.

The one position where, if anywhere, such bright sources are permissible (so far as glare is concerned) is immediately overhead. It has been suggested that the vertical angle between the direction of vision and a line joining the eye to the unshaded source, should not be less than 60 degrees. In these circumstances the eye is shielded by the brow and upper eyelid, in a manner possibly contrived by Nature as a protection from the sun's rays. The corresponding protection from direct rays reaching the eye from below is much less perfect, and therefore glare in the form of reflected light from polished surfaces of desks, highly calendered paper, &c., is apt to be distressing. But while the presence of a bright source of light in the field of view will in general prove distracting and produce discomfort, it does not invariably diminish acuteness of vision. It may even temporarily increase it, though one would presume at the expense of a certain strain on the eye.

While dealing with this question of contrast, I may refer to another debatable point—the relative merits of the so-called general diffused illumination and local concentration of light. Here again I do not think that I can adduce direct physiological evidence; but I consider conditions of moderate contrast—a *via media* between sharp contrasts and monotony of effect—desirable. I have been asked, for example, whether a limit on physiological grounds could be given for the relative brightness of walls and ceiling, or between the illumination on the work and surroundings. It is possible that, as has been suggested, it may be a relief to the eye for the gaze to be occasionally transferred from a bright area to one of subdued brilliancy; but the contrast should not be too sudden, and ought probably not to exceed the ratio of 100 : 1 suggested above.

Here the time element also comes in. There is the trying effect of rapid fluctuations in brightness, such as may occur in cinema theatres, &c. A parallel case is the experience of a worker whose eye is constantly roving over several machines receiving local illumination; and therefore experiencing rapid fluctuations in brightness. It seems reasonable to suggest that in such cases the illumination should diminish gradually on either side of the work, and that the adjacent area for a certain distance on either side of it should receive some illumination. In fact, local illumination of this kind ought always to be supplemented by moderate general illumination.

Effect of Colour.

Yet another problem is the effect of colour. Is it possible to state that light of certain colours is more agreeable or less fatiguing to the eye than others—to justify, for example, the preference often expressed for the mellow yellow light of the oil lamp? While prolonged exposure to light of certain wave-lengths only might conceivably be prejudicial to the eye, or have a disturbing effect on colour vision, there hardly seems at present sufficient evidence to dogmatize on this point. It is interesting to note that according to Ferree's observations apparently the yellow light of an oil-lamp or the blue of a "true tint" electric incandescent lamp were more fatiguing than the nearly white light of a half-watt lamp. It appears as if any coloured light might be considered inferior to white in the aspect considered, but it is difficult to suggest physiological grounds.

A Test for Eye Fatigue.

The next point I have been asked is whether it is possible to contrive a general test of eye-fatigue, such as could be applied to demonstrate the effect of different systems of illumination, or indicate whether the illumination is adequate for the work? Here you meet in an acute form the difficulties of the physiological side of illumination. Various conditions are classed under the heading of eye-strain. General bodily fatigue reacts upon the eyes, and the same is true of ill-health. Conversely, a continual strain on the eyes might in some cases not reveal itself by deterioration of that organ, but by headache, or other symptoms of general physical discomfort. Again, assuming that one has evolved a satisfactory test of eye-fatigue, one has the further problem of separating the fatigue due to defective illumination from that arising from overwork, and similar extraneous factors. I mention these points to show that very careful investigation is needed before one could come to a definite decision.

The Eyesight of the Nation.

Finally, there is the very wide question of the influence of conditions of illumination, both natural and artificial, on the eyesight of the nation in general, as a factor in the causation of blindness. It goes without saying that any deficiencies in illumination that impose a strain on the eye may have a cumulative prejudicial effect, especially if a predisposition to weakness exists. I concur with the suggestion that an investigation into this point might lead to some very useful information being acquired.

Gas for Artificial Flower Making.

It appears, from an article by Mr. Robert E. Livingston in the "American Gas Engineering Journal," that in practically every process of artificial flower, fruit, and vegetable making, gas is used extensively. Describing one particular New York factory, he remarked that by gas steam is generated to dye feathers and materials for flowers and fruits; and, in addition, the gas-fired boiler provides steam to coils of pipes round the drying-rooms. Brightly-coloured glue in troughs is, of course, kept hot by gas; and, again, gas is used in heating the tools which crimp the petals of flowers. Then there are gas-heated presses, which mould the leaves and foliage into shapes. One of the most effective appliances employed in the artificial flower maker's work is a large melting-pot for wax, with steam-pipes inside the iron walls. These pipes are attached to the gas-fired boiler; and it takes them only a few minutes to bring a mass of wax to the condition requisite for use. In the extensive artificial flower industry of Manhattan, served by the Consolidated Gas Company of New York, the use of gas is conspicuous in all departments, from the first dyeing of materials to the final crimping of petals. New devices are continually invented to facilitate the processes; but even without any more, manufacturers are convinced that gas furnishes them with the most efficient heating power, at the least cost, for their various needs.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Supply of Coal to the Isle of Wight.

SIR,—Having regard to the vital importance of the maintenance of gas supply to the public and the recovery of toluol for the Ministry of Munitions of War, you may think the enclosed correspondence of sufficient public interest to merit a place in your columns.

The present development is only the final step in a long series of difficulties which we have encountered.

JNO. S. INESON.

Ventnor, May 14, 1918.

[COPY.]

Board of Trade, Coal Mines Department,
Holborn Viaduct Hotel, London, E.C., Feb. 26, 1918.

COAL FOR THE ISLE OF WIGHT.

Dear Sir,—It has come under notice that, commencing July last year, large consignments of gas coal from various collieries in the Northern part of the country have been forwarded by rail *vid* Southampton, and which, previous to that date, were conveyed by sea from the East Coast ports in Northumberland, Durham, and Yorkshire.

To a great extent, this is responsible for the restrictions the L. & S.W.R. are constantly enforcing on the forwarding of coal traffic for the Isle of Wight; this resulting in the blocking-back of wagons on route, and thus adding to the congestion, &c., at various junctions and sidings on the principal trunk railways in the country. Under these circumstances, it has become necessary to restrict the forwarding of coal *vid* Southampton; and to this end I shall be glad if you will at once make arrangements for the gas coal for the Isle of Wight conveyed by sea previous to July, 1917, and now passing by rail *vid* Southampton, to revert to the sea route, advising me when you have been able to do this.

S. H. HUNT,
For the Controller of Coal Mines.

Ventnor Gas Company, Ventnor, I.O.W.

Ventnor Gas and Water Company,
May 11, 1918.

Dear Sir,—Referring to your communication of Feb. 26 last, which was placed before the Board of Directors, I am instructed to inform you that we have not been able in any way to obtain a cargo of coal by sea since January last.

Of tonnage employed in this last delivery by sea, one-half was commandeered and filled with household coal. Owing to the fixing of a uniform freight of 24s. 6d. per ton to the Island, the whole of the East Coast being covered by the same rate, shipowners will not now charter to the Island when they can earn as much by travelling half the distance and being exposed to one-third the danger.

The supply of coal being thus entirely cut off by sea and rail, by official action, the Directors cannot accept any further responsibility for the performance of their statutory obligation to supply gas.

Board of Trade, Coal Mines Department,
Holborn Viaduct Hotel, London, E.C.

J. S. INESON.

Gasholder Stresses.

SIR,—Referring to my article in the last "JOURNAL," will you allow me to make the following correction, which I inadvertently omitted to do when hastily reading over the proof?

In commenting upon Force C [see second column, line 32 from bottom of p. 279] it reads: " . . . divided by the *weight* of the holder." Obviously, it should read: " . . . divided by the *circumference* of the holder."

F. S. CRIPPS.

Slinfold, May 14, 1918.

Stresses in Gasholders.

SIR,—In Mr. Robinson's letter last week, he has misrepresented your Editorial remarks. He affirms that you suggested he "had perhaps been led astray by the diagrams in the works of Mr. Cripps and Mr. Meade." You made no suggestion whatever that he had been "led astray" by any of my "diagrams," but by one of Mr. Meade's.

He also insinuates that he is indebted to me for nothing beyond the bare formula as published in the "Gas World Year-Book;" and that he has not seen my paper in the "Guide-Framing of Gasholders." If he was not acquainted with the "Guide-Framing of Gasholders," how is it he took upon himself to talk about it, as if he were fully conversant with it? If his knowledge on the subject is confined to bare formulæ given in the "Gas World Year-Book," I submit that he has no right to take up the position he did, and (as Mr. Hovey remarks) patronize or admonish the North of England Gas Managers' Association in the manner he did.

There are, however, unmistakable signs that he has made himself acquainted with my works (though it may be superficially). For example, in the report of the discussion I read that he "found that his original ideas were wrong, because he had ignored the question of *any hollow body tending to become spherical under internal pressure.*" In my "Top Curb" paper will be found these words: "Any hollow vessel subjected to an internal pressure tends to become a sphere." This was accompanied by a sketch illustrating it. [See p. 82, "Guide-Framing of Gasholders."]

The diagram now inserted in his letter indicates that a certain amount of light is gradually dawning upon him. This diagram has no counterpart in his paper, but may be seen on p. 80 of the "Guide-Framing of Gasholders." Nevertheless, it is evident from Mr. Robinson's other remarks he is still at sea.

The letters from Mr. Valon and Mr. Hovey are both to the point, and confirm the justice of my criticism.

Mr. Valon makes some interesting remarks on the uncertainty of stresses and the "factor of ignorance." The deformation of the crown, due to the contraction of the top curb and the expansion of the sheeting under stress, it will be recollected by some, was the subject of interesting experiments by Sir George Livesey about 35 years ago. These experiments, and the practical effect of the deformation referred to, were discussed in my paper on "Gasholder Crowns." [See the "Transactions" of the Gas Institute for 1884, and "Guide-Framing of Gasholders," pp. 86 to 99.] An interesting discussion followed the reading of the paper.

I might add, perhaps, that there is no structure, or member of a structure, subjected to stress, which is not subject to deformation, owing to the elasticity of materials, and of their varying homogeneity, as well as the effect of temperature. But we must not be too nice. Practically, as Mr. Valon intimates, we are bound to allow for these niceties by the "factor of ignorance." For if, in the ordinary way, with ordinary structures, we had to calculate, even approximately, the varying stresses due to deformation, life would be too short. Scientific works have been written demonstrating theories of elasticity and deformation in structures. But, after all, some allowance has still to be made to provide against many unknown factors—defects in materials and workmanship, latent stresses, and the like. Hence the necessity for the so-called "factor of ignorance."

F. S. CRIPPS.

Slinfold, Sussex, May 15, 1918.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for May 15.]

Nos. 7536—7961.

BALLINGALL, J. M.—"Heat-controlling means for hydrogen-gas plants." No. 7557.
COOKE, J. J.—"Gas-fittings." No. 7567.
CORTHESY, J. H.—"Means to generate gas or gases from coal dust, &c." No. 7710.
COULSON, W. T.—"Illuminating device" No. 7574.
DEMPSTER, R. & J.—See Ballingall. No. 7557.
GLOVER, S.—"Retorts for continuous carbonization of coal, &c." No. 7586.
GREGSON, W.—"Gas-heated furnaces." Nos. 7830, 7831, 7832.
HARGER, J.—"Manufacture of hydrogen." No. 7772.
IONIDES, A. E.—"Heating gaseous fluids." No. 7958.
MASEYK, A. E. W.—"Automatic coal-gas producer." No. 7765.
SODDY, F.—"Method for stripping illuminants from and purifying coal gas by means of charcoal." No. 7698.
TAUDEVIN, E. P.—See Gregson. Nos. 7830, 7831, 7832.
WEST, J.—See Glover. No. 7586.
WILD, W.—See Glover. No. 7586.

Wages at Bradford.—The question of wages of Bradford Corporation employees was settled last week by the acceptance by the workers, and confirmation by the City Council, of the War Wages Committee's offer of a general 2s. 6d. advance in bonus from Oct. 1, 1917, to Feb. 28 last, and an additional 1s. 6d. from March 1 onwards; bringing the amount for men to 20s. per week above pre-war rates, for women to 13s., and for youths and girls to 10s.—in lieu of the recent Arbitrator's award.

Gas-Works and Mineral Oil.—At Newton-in-Makerfield, the Gas Engineer (Mr. R. T. Surtees) reported to the Council that for the year ended March last, the yield of tar oil at the gas-works was 14·2 gallons per ton of coal carbonized; but if the process of "steaming" were adopted, this should be materially increased. Before using cannel instead of coal, he would fully experiment with the coal at present being employed. He further stated that it might be desirable to agree to help the Government in this matter as far as possible, provided there was no loss.

Fatality at Elland.—A verdict of "Accidental death" was returned in the case of Joseph Shillitoe, a workman at the Elland-cum-Greetland Gas-Works, who fell from a platform 25 ft. high, attached to a coal-conveyor. He had told a fellow-workman that he had tried to use a crowbar, as the belt was not running straight. Mr. E. Garsed (the Manager), in admitting that there was no handrail on the platform, said the man had no right to be there. A foreman and mechanic were kept for the purpose of making any adjustments. The Jury recommended that a rail be erected.

Birmingham Meter Test Results.—Reporting for the year ended March 30, to the Justices, Mr. F. Colburn, the Birmingham Gas-Meter Inspector, says the number of meters tested was 21,456; and the fees charged amounted to £720. The expenditure amounted to £718. Of the total tested, 958 meters, or 4·5 p.ct., were rejected as incorrect within the meaning of the Sale of Gas Act. It is shown that 7209 were ordinary meters, 14,184 prepayment meters, and 63 high-pressure meters of the aneroid compensating type. The number of new meters submitted was 5714, or 26·63 p.ct.; 15,642, or 72·9 p.ct. were repaired meters; and 100 consumers' disputed meters were submitted requiring certification. Of the wet meters tested 5·4 p.ct. were rejected; and of the dry meters, 4·1 p.ct.

Stockport Gas Charges.—As the result of a conference between Mr. James Welsh (the new Chairman of the Stockport Corporation Gas Committee), Alderman Brewster (the Deputy-Chairman), and Alderman Craig and Mr. J. R. Bell (members of the Committee), the Town Clerk has given notice to terminate the ordinary agreements with consumers of gas for industrial purposes. There is recommended to the Council the following revised scale of rebates per 1000 c.ft. per quarter: For all purposes other than gas-engines, for gas consumed on one premises—250,000 c.ft., and under 1 million, 1d.; 1 million and under 2 millions, 2d.; 2 millions and under 3 millions, 3d.; 3 millions and under 4 millions, 4d.; 4 millions and under 5 millions, 5d.; and 5 millions and upwards, 6d. For gas-engines—Under 1 million c.ft., 2d.; 1 million and under 2 millions, 3d.; 2 millions and upwards, 4d. These prices were to be subject to the usual cash discounts of 2d. per 1000 c.ft. for prompt payment.

THE "FINANCIAL HARDSHIPS" BILLS.

PROCEEDINGS CONCLUDED BEFORE THE HOUSE OF COMMONS COMMITTEE.

The Select Committee appointed by the House of Commons "to consider and report whether it is expedient that some provision should be made for the temporary modification of statutory requirements with regard to price and dividend in the case of gas undertakings whose financial circumstances have been injuriously affected by causes arising out of the war, and, if so, on what terms and conditions, and whether by Private Bill or General Legislation," concluded its sittings on Tuesday of last week. Reports of the earlier proceedings appeared in the "JOURNAL" for May 7, pp. 238-44, and May 14, pp. 288-93.

The members of the Committee are: Sir WILLIAM MIDDLEBROOK, Mr. ACLAND ALLEN, Mr. ANDERSON, Mr. ALLEN BAKER, Mr. FIELD, Mr. FLETCHER, Mr. MACMASTER, Mr. ROBINSON, Mr. STEWART, and Captain BARNSTON.

The Counsel appearing were as follows: For the promoters of the 24 Bills and one Provisional Order, Mr. HONORATUS LLOYD, K.C., Mr. G. J. TALBOT, K.C., Mr. VESEY KNOX, K.C., the Hon. EVAN CHARTERIS, and Mr. F. N. KEEN (Messrs. Dyson & Co., Parliamentary Agents); the London County Council, the Association of Municipal Corporations, and local authorities not owning gas undertakings (instructed as to the latter by the Town Clerk of Swansea), Mr. FREEMAN, K.C., and Mr. CLODE, K.C.; the Gas Companies' Protection Association, Mr. H. COURTHOPE MUNROE, K.C.; the Cardiff Corporation and the Twickenham Urban District Council, Mr. J. W. JEEVES; the Rhymney and Slaithwaite Urban District Councils, Mr. J. W. BAILEY; other parties, Mr. SZLUMPER and Mr. PRITCHARD (Parliamentary Agent).

Seventh Day.—Monday, May 13.

EVIDENCE OF MR. W. B. KEEN.

Mr. *W. B. Keen*, chartered accountant, said he had investigated the accounts of the companies who were promoting Bills, and had considered the financial circumstances as bearing on these Bills. He handed in tables as to twenty of the companies, giving analyses of their financial position, and said these enabled a fair opinion to be formed upon the proposals contained in the Bills. In the case of the five companies concerning which he had not prepared tables, he had not been able to obtain sufficient information. Taking the tables relating to the London Companies, witness said he agreed with the views expressed by Sir Harry Haward. In order, however, to illustrate what his tables were intended to show, he mentioned how the Gas Light and Coke Company had for the most part paid large sums in excess of the standard dividend, but that in 1917 the amount necessary to pay the standard rate was short by £43,483. The total working expenditure in 1913 was 18·35d. per 1000 c.ft.; and this had increased to 20·86d. in 1917. The tables showed considerable variation in the circumstances of the individual companies; so that it was impossible to lay down a general rule to be applied to them all. At the same time, although the circumstances varied, he had not found from his investigation anything that justified an interference with the arrangement of the sliding-scale, or with the arrangements under which maximum dividend companies were working. If the consumers were not already bearing the whole burden of the increased cost, the position would be very different, or, again, if the sliding-scale had been proved to be operated to the detriment of the shareholders. On the contrary, however, the sliding-scale on the whole had admittedly operated to the substantial advantage of the shareholders—in fact, it had probably done so more than was originally contemplated when it was first adopted. As he read the discussions concerning the introduction of the sliding-scale, it was contemplated that this would produce for the shareholders their standard dividend with some chance, given good management, of an addition. He very much doubted whether it would lead, without variation, to a permanent and regular addition to the former maximum dividend. Nevertheless, higher dividends than the standard had been paid; and these had been due to causes other than good management of the companies. The higher dividends had been mainly due to reductions in the price of coal. In the case of London, too, the abolition of the coal dues had had an effect in the same direction. Then there was the reduction in the illuminating power, and, later, the substitution of the calorific value test for the illuminating power test. Again, the right to set aside special purposes funds had assisted towards the payment of larger dividends in the sense that these funds had provided extra working capital and reduced the need for issuing further dividend-bearing capital.

Witness then dealt specifically with some of the Provincial companies; figures being compiled for the four years to 1913 and the four years to 1917. In the case of the Alliance and Dublin Company, this was a 5 p.ct. standard dividend concern; but in the two periods in question, the amount paid in dividends was less than the standard by £27,157 and £64,015 respectively. The Hastings Company paid £22,154 above the standard in the first period, and £11,538 in the second. The Liverpool Company were omitted from the tables because they only adopted the sliding-scale in 1914, and had paid the standard dividend since; but they had paid nothing above it. The Longwood and Slaithwaite Company paid £1232 more than the standard in the four years to 1913, and slightly less than this amount in the subsequent period. The outstanding feature here was the amount for repairs and maintenance—viz., 6·7d. in 1913 and 13·87d. in 1917. This was an extraordinarily high figure, and had contributed to the fall in the dividend. Taking the companies as a whole, the expenditure on repairs was extraordinarily varied. It was the practice of many companies to deal very liberally in the way of charging new capital expenditure as repairs, with a view to keeping the capital account low; there could be little doubt that 13·87d. must be in excess of what could properly be regarded as repairs and maintenance for the year, unless there were special circumstances of which he had no knowledge in connection with this Company. The amount was much in excess of what could be regarded as a normal figure. Taking the Provincial companies and local authorities given in Field's Analysis for 1913, the average allowance for repairs and maintenance in the case of the local authorities was 6·67d. per 1000 c.ft., and 6·98d. for the companies. In 1916, the figures were 6·44d. and 6·99d. respectively. It was fair to say that 7d. was the average total expenditure for repairs in the case of the large Provincial companies and local authorities; and anything in excess of this must be regarded as a matter requiring investigation. Another item in the case of the Longwood and Slaithwaite Company was coal, which had increased from 13·38d. to 21·68d.; while residuals had not only not increased, but had actually fallen by 0·55d. This must be attributed to some temporary cause, and should not be regarded as the permanent ratio between the price of coal and the yield from residuals. This would be a circumstance that would require to be carefully investigated before it was safe to say that the increase in the price of coal had any effect on the price to the consumer.

The CHAIRMAN: Would the control and fixing of prices of residuals affect your deductions with regard to Longwood?

Witness said it would have some effect. It was curious that the return from residuals dropped between 1913 and 1917; the percentage of the cost of coal received back in residuals being 84 p.ct. and 57 p.ct. respectively. The first was unusually high and the latter unusually low.

The Maidenhead Gas Company in the period to 1913 paid £1664 in excess of the standard dividend, and £3097 in excess during the war period. The cost of coal had risen from 18·291d. to 26·42d.—an increase of 8·13d.; while the return from residuals had increased 4·2d.—viz., from 8·48d. to 12·68d. Thus, the residuals had yielded proportionately more than the increase in the price of coal; and this was the main circumstance that had enabled the Company to increase the profit, which was £6814 in 1913 and £7308 in 1917. The deduction therefore was that Maidenhead could not be regarded as a case where any exceptional relief could possibly be justified. Moreover, the Company were still taking their 3d. neutral zone into account, 6d. below the standard price, which was 3s. 6d. The item of repairs and maintenance had increased from 11·12d. in 1913 to 12·03d. in 1917—a high figure in comparison with the 7d. already referred to.

The Newcastle and Gateshead Company paid £66,596 above the standard dividend in the 1913 period, and £55,356 in the 1917 period. The cost of coal had gone up in greater proportion; the figures being 14·51d. and 19·6d. for coal, and 11·59d. and 13·20d. for residuals for the respective periods. The other expenses had increased by 2·35d.; so that there was not a very substantial difference, and the dividend had been maintained above the standard. Moreover, the Directors in their last report had stated that it would not be necessary to reduce the dividend below the standard of 3½ p.ct. These circumstances indicated that there was no ground in the case for any special remedial measures to be applied. Repairs were not on an extravagant basis—viz., 8·37d. in 1917, as against 6·29 in 1913. The price had been increased to 2s. 10d.; but there was still a margin, with the neutral zone up to 3s. 4d.

The Portsea Island Company in 1913 paid £36,792 in excess of the standard dividend, and £28,784 in 1917. The figures in this case were very remarkable. Coal increased from 16·72d. in 1913 to 33·51d. in 1917—an increase of 16·79d.; and residuals, which were 6·22d. in 1913, increased only to 6·66d. in 1917—an increase of 0·44d. only. There must be something quite extraordinary to account for the residuals not moving with the increased price of coal. While the standard dividends on the three classes of stock were 10, 9, and 7 p.ct. respectively, the Company actually paid right up to 1915, 13, 12, and 10 p.ct.; in 1916, 12, 11, and 9 p.ct.; and in 1917, 11, 10, and 8 p.ct. In order to keep up the dividends, £16,709 was transferred from the insurance fund and £20,373 from the reserve fund. The Company, however, charged £50,722 as extraordinary renewals. The inference to be drawn from the Company's figures was that they sacrificed everything for the sake of keeping up the dividends; and it appeared to him that, even if the heavy increase in the cost of coal was *prima facie* ground for relief, it would be removed by the very unwise financial methods which had been adopted with regard to dividends, and also by reason of the fact that they had had very substantial sums by way of dividends in excess of the standard for a long period.

The Richmond (Surrey) Company paid £2722 in excess of the standard dividend in 1913, and £681 in 1917. Coal increased in cost by 10·25d., and residuals by 2·25d. Other expenses had increased by 3d. Repairs were not on a very extravagant basis—being 8·63d., compared with 8·13d. in 1913. His view in this case was that, considering the satisfactory dividends that had been paid, and the fact that there was a reserve, there was no possible ground for interfering with the sliding-scale.

The South Shields Company paid £11,954 in excess of the standard dividend in 1913, and £7608 in excess in 1917. In this case, coal had increased by 4·78d., and the yield from residuals had actually fallen by 0·371d. Dividends had been paid in excess of the standard in every year except 1917. Repairs in this case were small—10·46d. in 1913 and 12·1d. in 1917. The Company having had very substantial sums in excess of the standard and also having a reserve fund to which it could resort for a time, there was no ground here for relief. There

was the probability that the normal relation between coal and residuals would be restored in time.

The York Company was a maximum dividend concern until 1912. In 1913, the amount paid in dividends was £748 in excess of the standard, while in 1917 it was £2270 below. The sliding-scale in this case gave immediate benefit, as the price of gas was at once reduced and the dividend was increased. There had only been a very short period in which the Company could enjoy the benefits of the sliding-scale, and they would have to look to the future. In 1918, the Company actually reduced the price of gas by 3d. The expenditure on repairs was the extraordinary item in this case—it being 6·04d. in 1913 and 11·35d. in 1917. He knew nothing to account for this; and it was a circumstance which would need very careful investigation before any deduction could be drawn as to the fair profits of 1917. About 3d. or 4d. appeared to be the net actual repairs and maintenance, but depreciation was written off.

The CHAIRMAN asked whether, assuming there was an increase in repairs during the period to 1917, this would not be reflected in the extra cost of materials and labour.

Witness said undoubtedly this would be so; but his only comment on the point was that the local authorities, whom dividends did not trouble, had had such a small increase in repairs and maintenance. Certainly the heavy increase in the case of the companies would need close investigation before it was safe to assume that it represented repairs necessarily carried out in this period.

Continuing his evidence, witness called attention to the fact that, in those companies where the repairs were high, very little capital expenditure was shown. This was fair *prima facie* ground for saying they must have charged capital expenditure to revenue, because it was obvious that a company increasing its sales must lay mains, the outlay on which was capital expenditure. In every case in which he had been concerned as regards purchase by the local authority, this item involved much consideration before the arbitrator, because, in calculating the maintainable profit, it was necessary to eliminate the capital expenditure. This applied perhaps more to maximum-dividend companies than to sliding-scale companies, because the former could pay back-dividends out of the profits of future years; and this was the strongest argument against relief being given to maximum-dividend companies. The majority of companies had undistributed reserve funds which were available for extraordinary circumstances, and special purposes funds for ordinary revenue expenditure; and it appeared to him that, even if on other grounds the companies had a case for upsetting the parliamentary bargain with regard to the sliding-scale, there was no case for variation until they had used up their reserve funds. Indeed, he went still further, and said there was no case for relief until the companies had borne losses at any rate equivalent to the benefits they had received over and above the standard dividend, and over and above the maximum dividend to which they were originally entitled before the sliding-scale came into force. Neither the consumer nor the shareholder was responsible for the present condition of things, which he called a misfortune rather than a hardship, the greater cost of which the consumer was already bearing. The companies were asking to increase their standard price; and he did not know of any instance in which this had been done yet. Nevertheless, plenty of gas companies had gone through abnormal times, such as coal strikes; and he had never heard the suggestion put forward that, because of this, the standard price should be increased. The reserve and special purposes funds existed for extraordinary circumstances; and until they were exhausted no case existed for any alteration. As to the effect of the present position upon the raising of capital, he agreed with Sir Harry Haward that fresh capital would have to be raised by loan, which should be issued as redeemable capital; and this being so, he did not believe that the financial position of the companies would be affected. The majority of the companies had further increased the price to the consumer in 1918 in anticipation of heavier expenditure; but it was not unreasonable or unfair to judge whether the increases so made would prove to be necessary. It was very difficult to say whether these increases would be necessary. Residuals, for instance, might yield considerably more than they did in 1917; and many circumstances might arise which would show that the increases were not justified. In fact, York this year had reduced their price. Discussing the recent one-sixth reduction order, witness did not see any special reason why the gas shareholder should not bear his share of the reduction, and to that extent be in the same position as the shareholder in other commercial concerns which had been affected by the war.

The Cardiff Company was a maximum dividend Company, and had paid their maximum dividends right down to 1917. In that year the amount earned was £6067 less than the sum necessary to pay the standard, and in the previous year the deficit on this account was £10,212. The maximum dividend was paid, however, and special charges amounting to £19,484 were provided for. Repairs were high, but not abnormally. Coal increased by 10·82d. between the 1913 period and the 1917 period, and the residuals only increased in yield by 0·66d. This was a very prominent cause of the reduction in profits.

The Swansea Company was also a maximum dividend concern; and the maximum dividend had been paid throughout. The maximum price was now being charged; but the amount necessary to earn the maximum dividend in 1917 was short by £1871, after charging £3222 for depreciation, which was in addition to repairs and renewals. The cost of materials increased between the two periods by 11·59d., and the yield from residuals increased by 4·26d. An additional circumstance in this case why it would be unfair to give any relief to the Company was that the Local Authority had petitioned against the Bill, and were asking for powers to purchase the undertaking.

CROSS-EXAMINATION OF WITNESS.

In cross-examination by Mr. HONORATUS LLOYD, witness maintained that it was undoubtedly the fact that when the sliding-scale was first arranged the probability of war affecting the position of gas companies was taken into account. The operations of gas companies depended mainly upon the price of coal; and the possibility of variations up and down in the price of coal was clearly contemplated in the sliding-scale. The effect of a war on the price of coal was the same as a coal strike; and there had been coal strikes from which the companies had suffered without any increase in the standard conditions. Parliament must have had it in mind that the sliding-scale was a fair bargain which would operate under all circumstances.

Mr. HONORATUS LLOYD: That settles the whole question, then. If Parliament had in mind such circumstances as these, there is no case for any alteration.

Witness said that war was a temporary thing, but agreed that the matter was one of degree. When asked, however, how long he thought the war would last, he refused to prophesy. He maintained that the companies should go on as they are until they had exhausted all their reserve funds and suffered losses to the extent of the benefits they had received over the standard in past years.

Mr. HONORATUS LLOYD suggested that in the meantime most of the local authorities would have stepped in and purchased.

Witness replied that he did not know that this would be a bad thing for the public. He had not looked into the accounts of the local authorities. The position was not quite the same, however, because the consumers and the ratepayers were for the most part the same; and if there was a loss it would go on to the rates, which was equivalent to raising the price.

There was a long cross-examination on the witness's argument that reserve funds should be drawn upon. He asked why such funds should be provided for these special circumstances if they were never to be used. As to the length of time they would enable the companies to go on paying their standard dividends, he would not give an opinion. When the funds were exhausted, no doubt the financial position would be prejudiced; and when the point was reached that the standard dividends could not be paid, then perhaps the time might have arrived for suggesting an amendment of the terms.

Mr. MUNROE, on behalf of non-promoting companies. asked witness whence he derived his inference that what was true of the promoting companies was also true of the non-promoting companies.

Witness said he stated it because it seemed likely that those companies who were likely to suffer most would be the most likely to have come forward with Bills. Perhaps he ought not to have carried it so far. He recognized that other companies might have circumstances which would entitle them to ask for relief, which did not apply to the promoting companies.

RE-EXAMINATION OF WITNESS.

Re-examined by Mr. FREEMAN, witness said he saw no justification for putting gas companies in a different position from any other commercial undertaking in regard to the effects of the war. The main part of the increased costs due to the war had already been placed on the consumer, who also had an inferior quality of gas.

The CHAIRMAN asked if it was not the fact that during the years that the companies had paid dividends above the standard the consumers had received a benefit in the reduced price of gas.

Witness said the price had been lowered, but not so much as it would have been under the old maximum price arrangement, when all the benefit of improved working went to the consumer.

The CHAIRMAN asked if witness did not consider that each year, as regards the relation between dividend and price, balanced itself, and that the suggestion that companies should incur losses equivalent to the amounts they had received in past years above the standard did not really apply.

Witness said that, even if the companies went without dividends to the extent he had suggested, the sliding-scale could still be regarded as having operated fairly. Under the proposals now before Parliament, the companies wanted to charge the consumers with all the increased cost of production, and to get themselves a higher dividend than the standard. He agreed that the account each year as between the shareholder and the consumer might be regarded as closed; but the only consideration that should be given to an alteration of the sliding-scale was when the consumer asked for it. Until then, the present arrangement should hold good.

EVIDENCE OF MR. W. R. HERRING.

Mr. *W. R. Herring*, late Chief Engineer to the Edinburgh and Leith Gas Commissioners and now Supervising Consulting Gas Engineer to that body, handed in tables analyzing the accounts of various companies. He called attention to the high distribution charges, which often included items of a capital nature which were met out of revenue, thus taking money out of the consumers' pockets. Municipal undertakings did not bring in such high charges for distribution. In the case of the Gas Light and Coke Company the charge for distribution had increased from 2·58d. in 1875 to 6·47d. in 1916, the Commercial Company from 2·63d. to 5·99d., and the South Metropolitan Company from 2·18d. to 4·86d. The average of the large Municipalities was 2·26d., against the average of 6·6d. for the three London Companies in 1916. He did not think for a moment that anybody would suggest that the great municipal gas-works of the country were not properly maintained; yet the cost was so much lower. As to the increased cost of coal during the war, there had been a distinct tendency for the price to increase for many years past; but the sliding-scale had responded to the various fluctuations, and had met the circumstances—the sliding-scale still operating in favour of the companies. In regard to the gas made per ton of coal, he pointed out that in 1908 the London Companies made, on the average, 10,938 c.ft. per ton when the method of testing was by the No. 1 "Metropolitan" burner. In 1909, when the method of test was changed to the No. 2 burner, the quantity increased to 11,404 c.ft., and in 1916 the yield had risen to 12,608 c.ft. The average for the Provincial companies in 1908 was 10,847 c.ft.; and in 1916 it was 11,536 c.ft. In 1912, the quality of gas generally was about 12½ p.ct. better than in 1900. This was before the calorific value test came into use; but now it was 25 p.ct. worse on the basis of heat value. The effect of washing gas for the purpose of munitions was to reduce the heating value by 5 or 6 p.ct.; the remainder of the reduction was due to causes which he thought he could explain.

Asked by Mr. FREEMAN to explain them, witness said he had reason to believe that what the companies had been doing to a large extent—and it was borne out by the fact that the South Metropolitan Company's gas was much better than that of the other companies—was,

owing to the shortage of oil, and probably owing to a disinclination to use it on account of its high price, they had been using a smaller quantity of oil in the manufacture of carburetted water gas, with the result that they had made a very low grade calorific value gas in their water-gas plants which had been mixed with the coal gas, thus reducing the quality of the whole. Then there was another matter. The calorific analyses of the gas which had been made by the London County Council showed it to have been adulterated largely by inert gases; and this was specially so in the case of the Gas Light and Coke Company. As a practical man, he was quite satisfied that in the process of manufacture of coal gas they were exhausting the charge of coal in the retort and drawing in furnace gases and atmospheric air. There was no complaint against the South Metropolitan Company on this account; and the contrast was very striking between the two Companies.

Dealing with the effect on the revenues of the London Companies of the increases in price made in 1918, witness said that, assuming the same make as in 1917, the increase made in the price at the beginning of 1918 would add £910,294 to the gross profit of the Gas Light and Coke Company, which would make a total for the year of £1,939,474. This did not take into account the extra cost of labour and material which would arise in 1918. In the case of the South Metropolitan Company, the extra profit arising out of the increased charges in 1918 would be £533,412, making a total gross profit for the year of £852,146—again without taking account of the extra cost of labour and materials compared with 1917.

Eighth Day.—Tuesday, May 14.

Witness, continuing his evidence-in-chief, said he had originally estimated the extra cost of labour during 1918 at 2d. per 1000 c.ft.; but as Mr. Milne Watson had put it at 2½d. to 3d., he would accept this. In giving the figure of 2d. per 1000 c.ft. as the increased cost of coal in 1918, the Companies had, in his opinion, omitted to take credit for the increased values that were certain to arise in 1918, and were already arising from residuals. It had already been said that the producers of sulphate of ammonia had made arrangements with the Government Department concerned to receive an extra 15 p.ct.; and on the whole he calculated the London Companies would benefit in 1918 to the extent of an additional £70,000 to £80,000 from this course, which was equivalent to ½d. per 1000 c.ft. With regard to coke, the average price received last year by the South Metropolitan Gas Company was 23s. 4d. per ton. But the price was now 3s. or 4s. per ton more than this; and generally there was bound to be a better price received for coke owing to the shortage of coal. In pre-war times, it was usual to gauge the transactions in coke in relation to the price paid for coal. In 1910, the price of coal on the works was 12s. per ton, and the price realized for coke was also 12s. In 1912, coal was 12s., and the price realized for coke was 13s. 6d. There were 10 cwt. of coke available for sale per ton of coal carbonized. In 1913, the price of coal was 14s. 7d., and coke realized 14s. 5d.; while in 1917 coal was 29s. 3d. and coke fetched 23s. 4d. There were special reasons why a better price was not realized for coke last year in the South of London—among them being the rationing. Naturally the householder, being limited in his purchases, preferred to buy coal than coke. Then there was great difficulty in getting delivery; so that the coke could not be got away from the works. Private consumers used 70 p.ct. of the coke available; but in 1918 he believed the price would move more in sympathy and accord with the price of coal. There were considerable stocks of coke in London last December. Indeed, all over the country the stocks were large; but he fully anticipated that the temporary difficulties in the way of its use would disappear, and he had estimated that an extra 4d. or 5d. per 1000 c.ft. of gas might be expected from the increased revenue from this course. Tar products had enhanced in value since last autumn. In his own case, he was getting 6s. per ton more for tar than he was in October last year. The percentage of the cost of coal received back in revenue from residual products varied in different localities. In the case of the Brentford Company, it was 53 p.ct. in 1913 and only 39 p.ct. in 1917. If they could get back to the 53 p.ct., it would represent 5d. per 1000 c.ft. of gas sold. He had similar figures for other companies; the extra revenue from the increased sales of bye-products varying from 3d. to 5d. per 1000 c.ft. In the case of Cardiff, it was 6d. He was surprised to hear Mr. Carpenter say there might be a decrease in the revenue from residuals, because coke and tar were fetching higher prices, and a better price was to be paid for ammonia products. If the companies adopted the same policy with the Government department concerned with toluol and benzol, he thought they would get a fair market price, which at present he admitted was not being paid. Therefore, he fully believed that the increased revenue from residuals would more than counterbalance the extra expenses.

Witness Cross-Examined.

Mr. Honoratus Lloyd, in his cross-examination, obtained from witness an admission of the growth of the feeling in the gas industry on the matter of relief, and that he himself had taken an interest in it. A long series of questions were then put as to witness's presence at the meeting of the industry called by the National Gas Council last autumn, and the attitude he adopted there. For this purpose, Counsel used the "Journal" for Oct. 16, p. 116-117, containing the report of the meeting.

The facts which Mr. Honoratus Lloyd elicited may be summarized as follows: Mr. Herring attended the meeting and signed the attendance sheet as attending on behalf of Edinburgh. At the same time, he said he was not commissioned to attend on behalf of Edinburgh, which, by reason of its peculiar circumstances, was able to—and in fact had—put the whole of the extra costs due to the war on the consumer; each year being budgetted for in advance in the endeavour to make revenue and expenditure balance. Thus Edinburgh was not interested. Witness said he attended the meeting at the special request of the Dover Gas Company, and agreed that he did not protest against the first resolution which set out the 80 p.ct. and 20 p.ct. proposal. He said that he went to the meeting merely to see what took place and report. In the case of the second resolution, which proposed an advance of 6d. per 1000 c.ft. in the case of maximum price companies, witness accepted the "Journal" report that he suggested that the figure should not necessarily be limited to 6d., but that it should be 6d. or such larger sum as the Board of Trade might determine. The reason for this was that he gathered from the Chairman's opening remark that negotiations had been going on with the Board of Trade, and that the principle of relief had been accepted, and that it was only a question of deciding the amount. He was professionally representing a South of England Company, and naturally wanted to do the best he could for his client. As a matter of fact, he reported in favour of standing by, as he believed things would improve during 1918. At that time the whole thing was new; and he simply attended, as requested, with a view to making a report. He did not know that the industry had not approached the Board of Trade on the matter at that time—indeed, he understood the contrary from the opening remarks of the Chairman. This was the first time he had heard that stated. The Dover Company had been hard hit by the war—not having earned their standard dividend last year. Their coal was up as well as labour and materials, and they were suffering from freightage difficulties. They were now receiving a large quantity of coal by rail instead of by sea; and the position had improved to this extent. His suggestion that the increase should be 6d. or such sum as the Board of Trade might determine was made in a spirit of caution of wishing to leave things open as far as possible. He was consulted by the opposition in the present case early this year or late last year; and he had been approached in the matter by several important municipalities not owning gas-works, although he did not dispute that the municipal owners of gas undertakings took the same view as the companies.

Some questions were then put with regard to the Edinburgh and Leith undertakings. It was agreed that the net cost of coal was 1·55d. in 1913 and 6·81d. in 1917, and that the total net coal and working expenses had increased from 18·17d. to 26·11d. in the same period. Witness did not remember what he budgetted for at Edinburgh for the current year, which ended on May 15, but he expected to be 2d. per 1000 c.ft. behind. The quality of the gas at Edinburgh was on the average 525 B.Th.U., and it was tested every day.

Mr. Honoratus Lloyd suggested that it was 488 B.Th.U.

Witness was emphatic, however, that never in the whole history of the Edinburgh undertaking had it been so low as this. It was probably nearer 588, as, prior to extracting benzol and toluol, the figure was from 575 to 590 B.Th.U.

Mr. Honoratus Lloyd said it had been tested since witness gave his evidence, and it was 488·4 B.Th.U.

Witness said the figure was quite wrong. [Later, in reply to the Chairman on the same point, he said he would stake his existence on it that the figure was quite wrong.] The percentage of inerts was 7 to 9 p.ct. (Mr. Honoratus Lloyd said it was 17 p.ct.) Tests of the Gas Light and Coke Company's gas in 1917 gave an average of 501·1 B.Th.U., after washing for toluol and benzol, which accounted for from 5 to 6 p.ct.; and witness agreed that, as made, the gas was well above the Board of Trade standard of 500 B.Th.U.

Answering questions as to oil, witness agreed there was a shortage; but he maintained that if the companies had been content with a less make of gas, they could still manufacture a good water gas and mix it with coal gas. This apparently was done by the South Metropolitan Company, whose gas he looked upon as a good standard. He could not understand why the South Metropolitan Company should anticipate a less return from residuals in 1918, although it was true the yield dropped from 74 p.ct. of the cost of coal in 1913 to 60 p.ct. in 1917.

Mr. Honoratus Lloyd said that Mr. Carpenter, in giving this opinion, was speaking from experience of the hard facts.

Witness said he did not anticipate that any bye-products that were now controlled would be released from control; but he pinned his faith to a large extent to coke, which he refused to agree had dropped in price this year. Contracts entered into by the London County Council were at prices 5s. per ton more than the previous ones. He had confirmed this by ascertaining yard prices last week. Therefore, he was justified in saying that the price of coke was better now than last year, when it was only 23s. 4d. per ton.

Mr. Honoratus Lloyd said that not only were the gas companies' yards filled with coke, but it had actually had to be barged down the river to get rid of it; and this fact obviously tended to lower prices.

Witness agreed that the financial position of gas undertakings had been adversely affected by the war "to some extent;" but he held to his opinion that the present state of affairs was foreseen when the sliding-scale was first taken into consideration.

Re-Examination of Witness.

Re-examined by Mr. Clode, witness said that the figures for 1918 were estimates on both sides; and he was as much entitled to make such an estimate as the witnesses on the other side. Indeed, as he had been estimating for the purposes of the Edinburgh budgets for twenty years, he might claim to have had more experience than any other gas engineer in the matter of estimating. On the question of inerts, he said the percentage in the case of the Gas Light and Coke Company was 20; the Commercial Company, 17·2; and the South Metropolitan Company, 12·3. This inert matter did not get into the gas in the process of washing for benzol and toluol.

Case for the London County Council and Other Bodies.

Mr. Freeman, addressing the Committee on behalf of the London County Council and the local authorities not owning gas undertakings, said he wished to put it clearly on record what the exact position was to-day, and how this position had come about. The matter arose by the introduction of 25 Bills for one purpose, although in somewhat different forms; this one purpose being to enable gas companies to divide more money among their shareholders than they were at present entitled to. The 25 Bills were challenged in the House, with the result that the Committee had been formed to inquire whether the time had arrived when it was expedient that, owing to the companies being injuriously affected by the war, some relaxation of the conditions under which they at present worked should be made. This immediately changed the whole aspect of the matter, because it brought under the consideration of the Committee 519 companies, involving a capital of

102 millions, and 312 municipal undertakings, representing a capital of 26 millions. In other words, the Committee had to consider 831 undertakings, with a total capital of 128 millions. It had been shown by the evidence that the circumstances of these undertakings varied enormously; and he asked the Committee what information had they had placed before them in respect of the various circumstances of the 821 companies, which would enable them fairly and fully to be able to say that, as regards gas undertakings as a whole, an alteration should take place? There had been certain tables put in by Mr. Cash which gave very general information indeed as regards the statistical parts of the case, and there had been evidence given particularly by the representatives of the great London Gas Companies; but he ventured to say that this clearly showed that these Companies were not in any need of relief whatsoever. Then there had been evidence as to Liverpool and Southampton. These, however, were admittedly exceptional Companies—Liverpool because they had so recently adopted the sliding-scale, and Southampton because all the calamities from which they had suffered were due almost entirely to outside action on the part of the Government in taking their steamer and their misfortune that other steamers which they chartered had stranded. It was on this evidence that the Committee were asked to say there should be an alteration of the sliding-scale that had existed for 40 years, and which admittedly had worked to the benefit both of the consumers and the shareholders. He submitted that this was absolutely insufficient evidence. Supposing for the moment that the Committee considered it was their duty to report that some alteration should be made, there would be a very grave feeling of surprise on the part of the consumers; and he did not suppose that the matter would be allowed to end, but that some very strong protest would be made by them. He wished to put it quite clearly, however, that those whom he represented did not appear in any sense in a spirit of hostility to the gas companies. The gas companies were necessary to those whom he represented; while, on the other hand, they, in turn, were necessary to the gas companies. It was not desired to deal in any way unreasonably or unfairly with the companies, because this would only redound to the public discomfort in the end; but he intended to bring before the Committee certain arguments which would show that the companies had misunderstood their present position, and that the necessity in the circumstances that now prevailed was not such as to justify an interference with the arrangement that had been come to between both sides. He was not there to suggest that the sliding-scale was a thing that was fixed as one of the laws of the Medes and Persians, and that under no circumstances whatever should it be altered. He was perfectly aware that Parliament, if it chose, could do anything it pleased to alter any arrangement; but he was going to ask the Committee to be extremely wary not to interfere with an arrangement which was arrived at, because of a very great deal of dissatisfaction with the position as it then stood, and which was arranged after an immense amount of trouble by some of the best brains in the country at the time. It was an arrangement arrived at to put an end to a state of things in the supply of gas which, in the words of the then Mr. Livesey, "shocked the conscience of the country."

The companies consisted of sliding-scale and maximum price companies; and so far as the former were concerned, there was nothing which would justify the Committee saying that their financial circumstances had been so injuriously affected that it was expedient in the public interest that any alteration should be made. In none of the cases put forward had there been any special hardship; and he took it that, in presenting their case, the promoters had selected the best instances for their purpose. These companies were in the strong position that they could make up dividends lost in bad times out of the profits made in good times. Many of them still had margins between the price they were charging and the maximum which they were entitled to charge; but, on the whole, the evidence with regard to their actual position was not very complete, although it was known that they were companies who had the protection of being able to pay back-dividends. Five such companies had promoted Bills, and, as regards two of them—Swansea and Cardiff—they were paying their maximum dividends. Garw and Ogmore had paid their maximum dividend up to the war, but had failed to do so since. Southampton was a case entirely apart, as he had already mentioned. Of the Rhymney and Aber Valleys Company the Committee had had no information, except that they were in difficulties as early as 1904 and 1905. Therefore the real question before the Committee was that concerning the sliding-scale companies.

Counsel briefly outlined the circumstances which led up to the sliding-scale in 1875, as already given by Mr. Honoratus Lloyd, whose account he accepted as accurate, and said that by the arrangement the consumers gave up a very substantial thing—viz., the right to all the benefits that might accrue in the way of reduced price from improvements in management of the companies. Up to that time, however, there was nothing to ensure that the companies would be managed in the most economical manner; and it was to secure this that the sliding-scale was introduced. The "partnership" had resulted in very satisfactory consequences, both to the companies and the consumers. It had enabled the companies to pay 6½ millions beyond the 10 p.ct. dividend which they were entitled to pay before the sliding-scale, and it had given to the consumers in many cases cheaper gas. The sliding-scale provided that any increase in the cost of manufacturing gas should be borne in the proportion of 6-7ths by the consumer and 1-7th by the company; but now the companies said that, because there was exceptional pressure upon them in the cost of manufacture, 80 p.ct. of the 1-7th of this extra cost should fall upon the shoulders of the consumer, in addition to the 6-7ths which they at present bore. He ventured to say that, before such a proposition was justified, it would need a very much larger amount of evidence than had been placed before the Committee. It would be necessary to show that the companies as a whole, and not one or two isolated companies, were near the end of their tether, and that it would be impossible, unless they had some relief, to continue to do their duty to the public.

The sliding-scale provided for reserve funds for the express purpose of making up dividends which might not be earned in any year; and the companies had taken advantage of this during the war. If the companies desired to pay higher dividends, it was quite open to them to reduce the price of gas, and make up out of the reserve fund the higher dividend which it was desired to pay. The argument which was the keynote of the case for the companies was that in normal circumstances they would not ask Parliament to interfere with the sliding-scale; but something abnormal had happened which nobody could by any possibility have foreseen in 1875—that nobody could have foreseen this war. But in 1875, when the sliding-scale was arranged, there had just been very analogous circumstances; and as a result some companies had actually put up their prices to very nearly the prices that were now being charged in various parts. Just before the 1875 discussion on the sliding-scale, some companies had made application to Parliament to increase their prices on the ground of increased wages and cost of materials—circumstances which were largely brought about by the Franco-Prussian war. Therefore, he considered it could fairly be said that the 1875 bargain was not a bargain made in ordinary circumstances, but was an arrangement come to in circumstances very analogous to those now existing. The historical sequel to the introduction of the sliding-scale was a period of very great prosperity for the gas companies; the South Metropolitan Company having divided £169,000 more than the maximum dividend under the old arrangement, the Commercial Company £74,000, the Brentford Company £102,000, and the Gas Light and Coke Company £190,000. Meantime, the consumers had received very substantial amounts by way of decreased charges for gas. But the companies were now asking not to increase the price of gas, because they could do this if they were content to divide less dividend, but to be allowed to divide higher dividends than under the present arrangement they could divide.

The case for the gas companies was that nothing had happened by the action of the companies to cause them to reduce the dividend; but neither had anything happened on the part of the consumer which justified him being put in a worse position than he was when the sliding-scale was first introduced. In a partnership such as this was, both sides suffered; and what was the justification for one party to the bargain trying to put the whole of the burden on the other party? He did not dispute that the war had put extra charges on the cost of manufacturing gas, and he did not think that it was at all necessary to have inundated the Committee with all the tables that had been put in showing the rise in the cost of materials, coal, and labour. He admitted this; but he did not think it would be so serious in 1918 as the companies had made out, because they had not taken into account the proper amount they were going to receive from residuals. Moreover, the companies appeared to anticipate an indefinite continuation of the war. The only justification for what was proposed was that the present position would affect the financial stability of the companies when they came to raise capital in the future. That was the evidence of Mr. Cash. But against this was the evidence of Sir Harry Haward, who had pointed out that it would be the wise thing to raise capital now by means of loans redeemable in a certain number of years. Sir Harry Haward had also expressed the view that the companies' financial position after the war would not be affected. Thus there was no evidence of public interest in the proposals which had been put forward by the companies; and he could see no reason why the Committee should be asked to tear up the agreement which had existed between the gas companies and the public for so many years.

Railways had been mentioned as analogous; but there was no comparison whatever between the two, nor was there between tramways and electric light. In all these cases the conditions were totally different. There was no sliding-scale, and, so far as the tramways were concerned, the London County Council was merely increasing fares within the legal maximum for the first time after four years of war; whereas the gas companies had already done this, and were now seeking to do more. The broad question was whether the Committee could, with the materials which had been placed before them, come to a conclusion which would enable them to say that there was such an injurious affection as would justify them upsetting the existing arrangement which had worked so well for all these years, and as would justify taking the whole of the burden off one of the parties to the arrangement and putting it on to the other. He submitted that no public case had been made out for such a change, and that what was proposed was purely and simply for the convenience and safeguard of the companies at the expense of the consumers.

The Position of Large Corporations.

Mr. PRITCHARD (Parliamentary Agent) renewed his application to be heard, at some stage of the proceedings, on behalf of some large corporations owning gas-works, before the Committee came to any decision against what was proposed by the large companies.

The CHAIRMAN said the Committee would like to know the broad points which Mr. Pritchard desired to deal with. They were taking the broad view that the first thing they had to decide was whether or no it was expedient to make any change in prevailing conditions. On this matter they felt that the evidence already given had placed the position of all gas undertakings, large or small, fully before them, and that they had all the material on which to come to a conclusion. There was, however, the further question which might possibly affect Mr. Pritchard; and the Committee certainly did not wish to shut out any evidence from the large municipal corporations that would give a different point of view from anything that had been put before them. Assuming the Committee came to an affirmative decision on the first point he had mentioned, it would apply in different degrees to different classes; and Mr. Pritchard's clients might be in a class by themselves. Could Mr. Pritchard indicate just what was his point of view in this respect?

Mr. PRITCHARD said he could only do so quite broadly. His position was the same as that of the companies having a maximum charge; and in the case of the municipalities, as with the companies, this maximum could not be exceeded. If, therefore, they had to meet the additional expense of the war, and could not increase the price to make good the deficiency, there would have to be a call on the rates, which would be a hardship on the ratepayers. He would have to call evidence on the matter, and would like to be heard at some stage.

The CHAIRMAN asked if the position was any different from that of

the companies, except that there was the possibility of a call on the ratepayers.

Mr. Pritchard said that, except to that extent, his position was the same.

The Chairman assured Mr. Pritchard that the Committee appreciated the position, and it would be borne in mind; but could he really usefully help the Committee on the one point which they were now considering?

Mr. Pritchard said he had not the full information at hand which would enable him to answer it.

Mr. Honoratus Lloyd said that, on the first principle, it seemed to him that the companies and the municipalities owning gas-works were agreed.

Mr. Pritchard thought they clearly were. He represented twelve large municipalities, some of whom had a maximum well above the actual price being charged. They were not very much interested; but it was the class of municipality which was up to the maximum which was suffering.

The Chairman said the view of the Committee was this: They recognized that the municipalities represented very large interests; but up to the present stage he felt they were protected by what had been put before the Committee by the promoters. If, however, the Committee reached the stage of attempting to apply any principle of adjustment, they would take care not to close the door against hearing the municipalities owning gas-works; and if they felt short of information from that point of view, they would ask the municipalities to attend later on and to take such course as they might think fit.

Mr. Honoratus Lloyd's Concluding Speech.

Mr. Honoratus Lloyd then addressed the Committee on the whole case. For this purpose, he said he regarded himself as representing not only the promoting companies, but all gas undertakings large and small. The question before the Committee was whether an absolutely different state of things had arisen, and whether the remedy which the gas companies were suggesting was a fair one. Running briefly once more over the history of the controversy, he pointed out that Mr. W. E. Forster, as Chairman of the Committee of 1875, had put it that the sliding-scale was a fine if a high price was charged and a reward if a low price was charged; and now that the industry was suffering from a state of things which could never have been foreseen, was it to be fined for its misfortune? Notwithstanding that the London County Council now came and said the sliding-scale was a bargain which should not be varied, they had never lost an opportunity of coming to Parliament and asking that it should be varied; and it had been varied whenever the conditions regarding the sale of gas changed, such as alterations in candle power and the introduction of the calorific value test.

One of the most important landmarks in the whole history was 1899, when Sir James Rankin's Committee was appointed on account of the discontent through the Gas Light and Coke Company's price being considerably in excess of that charged by the other companies in London. Before that Committee, Mr. Harry Haward (as he then was) said he did not regard the sliding-scale as fixed for all time. He agreed that Parliament had not been in the habit of making changes unless there was a substantial reason for doing so; and he was not asking on behalf of the companies now that the Committee should lightly depart from the sliding-scale as it existed. But the question was whether an absolutely different state of things had arisen as to justify some such remedy as had been proposed. Did anybody suggest that there ever was such a time before when everything synchronized against the working of gas undertakings as it had done during the war? Coal, freights, labour, and material had gone up to an enormous extent; but it was said, on the other hand, that the companies would be able to recoup themselves this year by the extra revenue from residuals. Mr. Charles Carpenter, who was responsible for the working of one of the companies, had told the Committee what he thought would be the case—that the yield from residuals would be less and not more. Bye-products were controlled and subject to prices which could not be increased. Some of them were taken by the Government for their own purposes, and were absolutely out of the hands of the gas companies. The only thing of which the prospect of an increased yield was true was sulphate of ammonia, the price of which had been increased by the Government. But Mr. Carpenter had said that this was taken into account in his figures before arriving at the loss for 1918. Moreover, had Mr. Herring told the whole story, or had he known it, he would have said that none of the London Companies, except the South Metropolitan, made sulphate of ammonia, as the Government took the ammoniacal liquor. No matter how much the output was reduced by the rationing order or by the restriction of public lighting, the standing charges went on, and, unlike an ordinary business concern, the companies were under a statutory obligation to go on.

It was said that the companies could draw on their reserve funds to make up their dividends; but it would not matter if the companies had a reserve fund of a million, because they could not draw upon it to pay more than the statutory dividend. He contended that the whole spirit of the sliding-scale was that the companies should earn more than the statutory dividend, provided due care and management were exercised. Then the opposition fell back on the reserve fund. This, however, was limited in total to 5 p.ct. of the capital; and even if the companies were entitled to divide it for dividend purposes, which they were not, how long would it carry them on for? Neither the reserve fund nor the insurance fund was ever intended to help to carry a company on through four years of war. Counsel commented strongly upon the suggestion of Mr. Keen that the companies should not only use their reserve and insurance funds, but should pay back the amounts they had received in dividends over the statutory amount before the question of relief from the stress of war could even be considered. Meantime, money was to be obtained on loan. Millions of money, he said, had been brought into gas undertakings by the investing public, knowing the dividends that had been prescribed by Parliament, and knowing the dividends that were being paid; and to act in the manner suggested would be a distinct breach of faith with the shareholders, because Parliament had said that not more than a certain percentage of the capital should be loan. So far as the maximum companies were concerned, he did not know what they were fighting about, because Sir Harry Haward had said that if they were not earning enough to pay their working and fixed charges their maximum should be raised.

The Claims of the Cardiff Corporation and the Twickenham Urban Council.

Mr. Jeeves, representing the Cardiff Corporation and the Twickenham Urban Council, also renewed his application to be heard at some stage of the proceedings. He asked for such an opportunity before the Committee dealt with the second part of the reference. If the Committee answered the first part in the affirmative, then he submitted it became a question of the particular circumstances in every case as to whether the record of the management was such as to justify any relief. In regard to one of the companies with which he was concerned, he believed he would be able to prove that they would not need any relief, and that there could be a financial modification in such a way that the consumers would not suffer. He wanted an opportunity to put this before a Parliamentary tribunal—either the present Committee or any other body appointed to determine the degree of relief in each case. He was instructed to press this very strongly.

The Chairman said the Committee had in mind the large number of Bills that had been promoted; but they were not concerned with the details of any particular Bill. They were only dealing with the general question of whether changes should be made, and, if so, on what terms and conditions. He thought Mr. Jeeves's position was very similar to that of Mr. Pritchard; and if it came to a question of settling terms in detail, the Committee would probably feel they ought to give each local authority an opportunity of being heard. He hoped, however, that, whatever the result of their first deliberation might be, it would not open the door so wide as that in regard to the second one.

The Committee then adjourned, the Chairman intimating that they would report to the House in due course.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bill.

The Wandsworth, Wimbledon, and Epsom District Gas Bill was read a third time, passed, and sent to the Commons.

Daylight-Saving Regulations.

Lord Rathcreedan asked whether, in view of the necessity for further economy in connection with heating and lighting, the Government would consider the advisability of adding another hour to the existing daylight-saving regulations during the months of June and July.

Viscount Sandhurst replied that one direct disadvantage of this would be in regard to agriculture; and it was generally felt that the hours could not be altered again without very considerable difficulties arising. There was a considerable amount of grumbling or dissatisfaction when the present system was brought about. The question had been raised in the House of Commons; and the Government did not see their way to agree to any modification of the existing system. The subject had been carefully considered and re-considered; and he was sorry to say that he was unable to meet the wish that it should be opened again.

Earl Russell remarked that in urban areas the further change suggested would practically lead to an almost complete cessation of artificial lighting for all private purposes. A considerable relief of power in the form of gas and electricity for industrial and war purposes would be a saving worth effecting.

HOUSE OF COMMONS.

Progress of Bills.

The Pontypool Gas and Water Bill was read a second time, and committed.

The Brixham Gas Bill was reported, with amendments.

A Gas Provisional Orders Bill—to confirm Provisional Orders made by the Board of Trade relating to Arlesey, Sheffield, Stirling, and Trowbridge—was presented by Mr. Wardle, read the first time, and referred to the Examiners.

A Gas and Water Provisional Orders Bill—to confirm Provisional Orders made by the Board of Trade relating (among other places) to Garw and Ogmore, and Llandrindod Wells—was presented by Mr. Wardle, read the first time, and referred to the Examiners.

The Wandsworth, Wimbledon, and Epsom District Gas Bill was read the first time, and referred to the Examiners.

Rationing of Gas and Electricity.

The President of the Board of Trade (Sir Albert Stanley), speaking in the House of Commons last Wednesday, said that, on the whole the system of rationing gas and electricity had worked fairly well. They had secured economy in the consumption of coal; and he was very thankful to all—particularly the gas and electricity undertakings—for their efforts. A new coal rationing scheme would shortly be issued; and this would be so arranged that it would not be possible for anybody to substitute one form of fuel for another, either for cooking or for heating, to the advantage of themselves. The rationing of domestic coal would be on a lower basis than last winter.

The Dyestuffs Industry.

Sir Albert Stanley stated, that in order to make the dye industry as rapidly as possible self-supporting, the Board of Trade had proposed to the dye manufacturers that where a manufacturer would undertake

to make special dyes, and was not in a position to secure the necessary money for an extension of buildings and plant, the Government would make a loan at a fixed rate of interest, in no case less than 5 p.ct. Some contribution would be made towards the cost of such extension; and there would be certain grants for research work. In order to safeguard the industry against German competition, the importation of all foreign dyestuffs would be controlled by a system of licences for a period of not less than ten years after the war. Negotiations were in progress for the amalgamation of British Dyes Ltd. and the firm of Messrs. Levinstein.

Chepstow Gas Bill.

This Bill was before the Unopposed Bills Committee of the House of Commons on Monday of last week; but as one or two minor points still have to be settled with the Government Departments, it will not be formally reported for third reading until the House meets again. A report of the Committee proceedings in the House of Lords was given in the "JOURNAL" for April 16, p. 104.

Distillation of Cannel.

Captain BARNETT asked the Minister of Munitions if the product now being obtained from the distillation of cannel coal at gas-works is of any value as Admiralty fuel; and whether the offer by the Controller of the Munitions Mineral Oil Department of a £2000 prize to any person who can make a satisfactory mixture of dehydrated coal tar and petroleum does not indicate that low-temperature distillation would be better adapted for the production of liquid fuel from cannel coal.

Mr. JAMES HOPE said it was expected that the product now being obtained from the distillation of cannel coal at gas-works would be of considerable value as an Admiralty fuel. The prize offered by the Controller of Munitions Mineral Oil Production Department was for a different purpose altogether, having as its object the utilization as fuel, in addition to cannel oil, of large quantities of tar at present available from gas-works not using cannel.

Captain BARNETT: Will my hon. friend consider the desirability of offering a similar prize for the best method of desulphurizing the Dorset and Norfolk shales?

Mr. HOPE: No doubt the desirability of taking this course will be considered.

MISCELLANEOUS NEWS.

GAS AND ELECTRICITY RATIONING ORDER.

Discussion by the Illuminating Engineering Society.

There was a discussion on the above subject at the meeting of the Illuminating Engineering Society last Tuesday, when the President (Mr. A. P. Trotter) occupied the chair. The Society have, with the concurrence of the Board of Trade, issued a list of recommendations as to economy in lighting, but it goes beyond the lighting limits. The print advises consumers to ascertain their past consumption from the gas and electricity supply undertakings. Then they are counselled to use their gas fires and electric radiators only when strictly necessary, and to dispense with them when the temperature in the working area of the town is above 60° Fahr. Cooking should be so arranged as to use ranges for a minimum length of time, and to their full capacity while at work. The use of hot water should be reduced to a minimum. In addition to economizing in the use of gas and electricity for heating, coal must not be washed. As to lighting, consumers are advised to avoid waste by using efficient burners, and not to indulge in extravagance in lighting, as well as to see that lamps and burners are installed in manner that will give their maximum effect. Carbon filament electric lamps and flat-flame gas-burners should be discarded. Cheap types of incandescent burners (both gas and electric) often mean waste and early renewal. Properly designed shades, globes, and reflectors (kept clean) are economizers, by directing the light where it is required. Lamp and illuminating accessories should be kept clean. This is only an indication of the lines that the recommendations take. There is much additional information, which concludes with some recommendations as to the adequate lighting of factories and workshops engaged on work of national importance. All the recommendations are as applicable to peace as to war time.

The PRESIDENT, in opening the discussion, remarked that scientific subjects generally supplied the members with topics of discussion; but the Council had felt it to be their duty to assist, if they could, the Board of Trade in the matter of the new Order. He could not confess that it inspired him with very much interest.

SMALL SAVING TO BE EFFECTED FROM LIGHTING.

Mr. L. GASTER (the Hon. Secretary) said he believed every technical society should give assistance to the State when it could do so. There had been a good deal of Press comment upon the Order; and the public regarded it as a sort of muddle, in that lighting, heating, and power had been dealt with in one Order. The Society were only interested in lighting; and all they could do to assist the public to make economies in this direction they should do. The recommendations offered by the Society were directed to showing the public how lighting economies could be effected. The Order might eventually require alteration; but whether the one-sixth reduction was or was not modified, he thought the recommendations had a permanent value. Subsequent remarks showed that Mr. Gaster considered there was much that was vague about the Order. For example, it stated that if a man made an alteration in his installation, he could be assessed as to the amount of gas or electricity he could have. The question arose as to what basis he should be assessed upon. Then, again, what "explanation" could be given by a man who had already made all the economies that could possibly be effected. In his opinion, too, it would be folly to make lighting regulations which would in any way affect the efficiency of factories engaged on work of national importance. As a matter of fact, the total amount of coal that could be saved through lighting economies was very small indeed in comparison with what could be done in connection with heating and power. Beyond what had already been done under the various lighting regulations, there could be very little scope for effecting coal economies through lighting. In his view, a rationing scheme should put rich and poor on an equal basis; and the consumer should be given an equivalent amount of gas or electricity to the coal saved, and sent from the domestic grate to the gas or electricity works. As a Society, they were anxious if possible to help the Board of Trade out of the trouble they were in regarding this matter. The objects of economy might be thus summarized: (1) Saving of labour in obtaining coal from the mines; (2) economizing transport facilities for the conveyance of coal to consumers; (3) relieving conditions where local gas or electric supply companies found any difficulty in meeting the demand; (4) the physiological effect of diminished lighting.

The speaker went on to say that it was desirable to have some idea of the amount of coal actually used for lighting. In 1913, the total output of coal in the United Kingdom was 290 million tons, of which approximately 190 million tons were reserved for home consumption. The coal used by electricity supply undertakings was stated to be about 4 million tons. Of the energy generated, about 25 p.ct. was used for lighting. The consumption of coal for electric lighting was thus roughly 1 million tons. Assuming, therefore, that every consumer reduced his consumption of electricity for lighting by one-sixth, the maximum saving in coal might be 150,000 tons—about 0·05 p.ct. of the total coal output. Actually, it might be less, because many consumers would necessarily be granted exemption or concessions under the Order. The possible saving due to diminished gas lighting was not so easy to ascertain. But the total coal furnished to gas undertakings was about 20 million tons, of which one-quarter was probably used for lighting. The total saving through the operation of the Order (assuming again all consumers reduced their consumption by one-sixth) might be about 600,000 tons. The total saving due to the reduction of both gas and electric lighting might therefore be estimated at 750,000 tons per annum, which, however, appeared to be a maximum not likely to be attained in practice. This figure was about 0·4 p.ct. of the total home consumption of 1913. On the other hand, it must be remembered that the total coal available for home consumption might now have to be diminished, and that the amount left over after satisfying the demands of munitions works and essential industrial operations might be much reduced. As to the illumination of the streets, he considered that this could hardly be further diminished without prejudice to traffic and safety. In regard to industrial lighting, experts agreed that hitherto the light used had in general been less than that required for the greatest efficiency of work, though no doubt there were cases of extravagant lighting, where diminutions under expert advice might profitably be made. As to domestic lighting, while opportunities of diminishing extravagant lighting in drawing-rooms, &c., should be taken, great care should be exercised in making reductions in rooms where children did their lessons, and in kitchens where food was prepared.

Turning to the Order itself, he said it had been urged that undue pressure was placed on consumers who had already patriotically made economies; that the thrifty and improvident consumers were treated alike. This objection was to some extent met by allowing either 1916 or 1917 to be taken as the standard. But, as the chief aim must be to discourage waste, a further concession might have a good effect. Burning coal in a grate was not the most efficient way of utilizing it. The case of a man who had already been using gas for heating in preference to coal deserved sympathy. Mr. Gaster asked what others have asked, Whether it would not be better to allow such a consumer to continue to use a proportional increase of gas or electricity as a substitute for coal, if he abstained from drawing his full coal ration? Another clause in the Order that might prove burdensome was the necessity—apparently imposed—of making one-sixth economy on every separate meter in a building. Surely, when a large consumer subdivided his lighting, heating, and power in sections, fed by different meters, but supplied by the same company, he should only be required to make the desired reduction on his total consumption. Then, again, where a consumer used both gas and electricity, he might find it difficult to reduce his consumption of electricity, but could make a larger reduction than one-sixth of his gas consumption, or *vice versâ*. Would it not be possible to meet all such cases by allowing a *pro rata* consumption in the three commodities—coal, gas, and electricity? It should be possible to estimate the proportional value of a corresponding reduction in either gas or electricity on the assumption that (say) 3 or 4 lbs. of coal were needed to produce 1 KW., and that a ton of coal would produce from 12,000 to 14,000 c.ft. of gas—due consideration being given to the other essential products (such as coke and the other derivatives) from the carbonization of coal. He had no doubt that factories with expanding production would receive judicious treatment on the basis of an assessment of their requirements. In the event of cases of dispute, he suggested the appointment by the Board of Trade of assessors with special knowledge of the requirements of the industry concerned.

THE COAL SITUATION.

Mr. E. WILLIS (Chiswick), one of the Coal Overseers of London, thought the Order represented an honest attempt on the part of the Government to feel its way in dealing with a pressing problem. There was no question about it the nation was in sore straits in regard to coal; and it would be in a much more difficult position before next winter. His own opinion was that the coal orders under the Defence of the Realm Act would have to be combined for both lighting and power. He believed the National Kitchens were going to assist in cutting down the consumption of fuel for cooking. There was, in his view, a distinct weakness in the rationing of coal on the number of rooms in a house; but the Coal Controller could not see his way to obviate it. It was manifestly unfair that a man and his wife living in a large house should have the same quantity of coal in time of war as a man and his wife with half-a-dozen children. In regard to factories,

he thought there was room for further economy in the transition period between a gang leaving off work and another gang starting work. During meal times, too, in factories he saw lights wastefully left on. There was room for economies in these directions. As to public lighting, he thought, except in main thoroughfares, the lamps could be discontinued during the night. Any economy helped.

Points the Government May Not Have Had in View.

Dr. J. F. Crowley remarked that the amount of saving that could now be effected by lighting was extremely small. There was a difference between economies in lighting and heating. Economy in heating might possibly produce discomfort, whereas economies in lighting might produce very serious results in accidents. In regard to electric lighting, the Government might possibly have had in view the improvement of the load factor. The peaks caused by lighting had a very serious effect on the generating stations; and the reduction of these peaks might make available for other purposes generators that were at present engaged as stand-bys for the peak loads. In making an Order of any kind, a Department had to compromise between what it was considered eminently desirable to do, and what it was practicable to do. The methods of using coal for domestic purposes were extremely inefficient. For domestic purposes, if they could increase the amount of heating done by means of gas, and cut down the amount of heating done by the ordinary grate, considerable economies could be effected. But apparently this had not been taken into account by the Order.

Mr. F. W. Goodenough remarked that probably Dr. Crowley had seen that Sir A. Stanley had said in the House, in answer to a question, that he was giving consideration to the question of the joint rationing of gas and coal, in order to avoid the particular trouble to which Dr. Crowley had alluded, of people transferring from the more economical way of using coal in its gaseous form to its use in the crude form. It might be interesting to mention that calculation and experience had shown pretty conclusively that 750 tons of coal sent to the gas-works, and turned into gas and coke, would do as much useful work in the domain of domestic heating and cooking as 1000 tons of coal used crude. This meant a saving of 25 p.ct. of the country's coal resources, and of the quantity of coal to be mined for the work to be done; and, of course, this represented a very material reduction of the amount of transport required, both from the pit to the town, and in the town itself, in the case of crude coal. Mr. Gaster and Dr. Crowley had referred to the small savings to be effected by lighting compared with the consumption of coal for fuel purposes. He (Mr. Goodenough) had no particular authority for saying so, but he thought the view of the Government in restricting the lighting was as much for the psychological, as for the lighting, effect. Nothing that he know of had made for economy more than by the lighting in shop windows and places of amusement being drastically cut down. He also alluded to the amount of light used in the underground railways; and, proceeding, said that in war time, they had got to put up with something less than the best. He thought it was a question of advertisement of economy to the public that the Government had in mind in insisting upon lighting economies in public places. There was undoubtedly a very great amount of economy to be effected in factories, more particularly at the present time; and he thought that one of the principal factors making for waste under present conditions was the arrangement under which a good many factories were working, whereby they were not paid fixed prices for what they produced, but a percentage on their costs. This was an absolute premium on waste. If the Government could get away from this pernicious system, he thought big economies could be effected. He had heard of gas-burners for soldering-irons being left on during the whole dinner hour; and, on a protest being made by a gas man as to the waste entailed, he was told that it did not matter to the firm, as they were paid for it in their costs. This was most immoral and most uneconomical. The proposition to turn out during the night all the street lamps, save those in the main streets, was one that would have to be considered by the police before it could be put forward for recommendation. There was an old saying that a lamp was as good as a policeman; and it was quite a question whether the police would care for the side streets in London to be left in darkness after midnight. In regard to both gas and electric lamps in the side streets, labour would be entailed in the turning out of the lamps, because the metal filament lamps were not controlled from a central station, but by individual switches the same as gas-lamps were controlled by individual burner cocks. It cost more in labour to send men out at midnight or 1 a.m. than the saving of gas effected. From the point of view of economy, there was nothing in it. Labour at the present time was a great difficulty all round.

Dr. Crowley observed that, as a member of the special constabulary force at night time, he strongly supported what Mr. Goodenough had just said.

Mr. F. W. Willcox pointed out that people could not at the present time provide all the apparatus and equipment to bring about improvements that would effect economies. In many directions only the desire could be created. Most fortunately, illumination was a class of work in which efficiency was very low as a rule. There was nothing a man used more wastefully than artificial lighting; but efficiency was capable of material improvement by adopting available material.

Mr. Dow gave some information as to the amount of light obtainable by different systems from a ton of coal.

The President said what annoyed him about this Order was that those who had hitherto responded most loyally to the request to assist the Government with economies, and had done all they could, should now be asked to take off a further one-sixth. The result was extreme confusion and uncertainty. He recounted his own individual difficulties. In gas and electric cooking and heating, he added, the appliances were only used as required, which was a totally different thing from coal heating and cooking. Therefore gas and electric heating and cooking should be encouraged, rather than the reverse. The whole thing wanted to be boiled down, and a new arrangement made. There was waste going on round about us every day. There were, for example, the big arc lamps with darkened globes in Westminster. The Electricity Company who supplied these lamps had begged to be allowed to replace them with 60-watt lamps, and so save 2000 tons of coal a year. The Coal Controller knew this perfectly well, but nothing had been done.

A few further comments from Mr. Gaster ended a discussion which, if it did not supply any solution of the problem as to how to achieve a fairer system of rationing, at all events showed there are numerous openings for coal economy by suppressing, as far as possible, the waste of coal in houses, and of coal, gas, and electricity in divers other places through carelessness and indifference.

EXAMINATIONS IN GAS-FITTING.

The questions set for the practical "Gas-Fitting" section of the recent City and Guilds of London Institute examinations were given on p. 297 of last week's issue. The following were the papers for the written examination on the same subject. In each case not more than six questions were to be attempted. The Examiner was Mr. Ralph Halkett.

Grade I.

1. Give a list of the various gas-burners in use, their illuminating power and hourly consumption. [50 marks.]
2. Describe your method of testing a new installation of gas-pipes for soundness, when no gas is procurable. [40.]
3. Fully describe a high-grade cooker. Give a sketch showing the construction of the boiling-burner of a cooker. [45.]
4. Sketch and describe a 14-in. frame gas-fire. State how you would fix same to an ordinary register coal-fire, and name the fittings that you would use. Is it necessary to enclose the fireplace with sheet iron? If so, why? [60.]
5. Give a complete list of tools used by a gas-fitter, and the purposes for which they are used. [40.]
6. Name the defects that may arise during the use of a gas-radiator, and state how you would remedy them. [45.]
7. Give the size of the inlet and outlet connections of a gas-meter for 5, 10, 20, 30, and 50 lights respectively. What is the maximum hourly registration of such sizes? [45.]
8. State step by step how you would proceed to make a ¾-in. upright joint and a ¾-in. tee joint with lead pipe. What precautions are necessary to avoid obstruction to the flow of gas? [55.]

Grade II.

1. By what test would you ascertain whether the products of combustion from a gas-fire are entering the room? If you find it to be the case, how would you overcome the difficulty? [40 marks.]
2. What amount of water can be condensed from the burning of 20 c.ft. of gas? Give a sketch of the method, and state how you would deal with a long length of flue-pipe from a gas-fire or other gas apparatus used for several consecutive hours per day, from which, owing to its length, the products of combustion are condensed. [50.]
3. Make a sketch of a complete hot-water system on the cylinder principle, showing a gas-circulator fitted to the installation in the most suitable manner to obtain the best results. [60.]
4. Give a sketch of a 5-light dry meter. Name each part, and state what are the general defects after a meter has been working for a period. [45.]
5. You are asked to supply a gas-meter for a 50 H.P. gas-engine. Show by calculation what size of meter you would instal. What size of service would be required, and what size of outlet-pipe would you recommend, assuming that the engine was fixed at a distance of 80 ft. from the meter? [45.]
6. Assume that you have to fix a cooker consuming 70 c.ft. of gas per hour. The supply is to be taken from a 1-in. iron pipe rising main, into which you have to insert a tee. From this there is a 20 ft. straight run of pipe, and then a straight drop to connect to the cooker. State step by step how you would carry out the work, the size of pipe that you would use, and name the fittings required. What points are to be observed when testing both the run of pipe and the cooker, when the gas is turned on? [55.]
7. Assume a gas-cooker fixed under ordinary conditions. The oven burners are lighted to heat the oven. The door is closed; but on opening the door a few minutes afterwards, the flames on one side are found to be out. Give reasons for the flames going out, and say what should be done to prevent the same thing occurring again. [45.]
8. A gas-service from main to meter has a defective stop-cock inside the building. You have to replace it with the gas on. State how you would proceed to do this, and the precaution necessary. [40.]

Final.

1. Describe (*a*) the construction of the different thermostatic valves, and (*b*) how they work. Why is it necessary to be careful to adjust the length of flame left when the thermostat is in action? [45 marks.]
2. Referring to a sketch given of a hot-water installation, to which was connected a gas-circulator, the question was asked: Are the pipes, in your opinion, properly connected to give good results? If not, state what alterations are necessary. It is intended to fix a second circulator to give quick results. Give a rough sketch of how you would connect it. [55.]
3. Pressure-charts [shown in the question paper] are from the inlet and outlet of a gas-meter supplying a gas-furnace. State what you consider to be the cause of the drop in pressure on the outlet; also the cause of the oscillation shown on both charts. What steps would you take to remedy such a complaint? [55.]
4. Describe the manufacture of a gas-mantle. What is the object of dipping the mantle into a solution of collodion? [45.]
5. Three rooms of equal dimensions require heating by gas. The size of each room is 40 ft. by 20 ft. by 10 ft. high, with two outside walls and three glass windows, 7ft. by 5 ft. One of the rooms having two fireplaces is to be heated by gas-fires. State the size of the gas-fires required, and the approximate consumption of gas per hour.

The other two rooms have no convenience for flue-pipes; and one is to be heated by hot-water radiators or pipes, and the other by gas steam-heated radiators. State the square feet of radiating surface required for heating by hot water (either hot-water radiators or hot-water pipes), and how many loops of radiators would be required in the case of gas-heated radiators. Explain how you arrive at your calculations. [50.]

6. What are the causes of the following defects in a gas-engine, and how would you remedy them: (*a*) Failure to start, (*b*) noises in the air or exhaust passages, (*c*) leaky pistons, (*d*) inefficient cooling of engine cylinder? [55.]

7. What would be the cubic contents of a cylinder 24 in. in diameter and 3 ft. 6 in. deep? State what size of gas-circulator you would recommend to heat the water in the cylinder, giving the hourly consumption of gas. [40.]

8. State the principles upon which increased efficiency is obtained by the use of compressed gas. Give the illuminating power of 1 c.ft. of 520 B.Th.U. gas at 2½ in. pressure, and at 80 in. pressure. [45.]

MONTE VIDEO GAS COMPANY, LTD.

Ebb and Flow of Consumption Increases—Long-Distance Difficulties.

The Ordinary General Meeting of the Company was held last Wednesday, at Winchester House, Old Broad Street, E.C.—Mr. CHARLES HUNT in the chair.

The SECRETARY (Mr. Henry Kearns) having read the notice convening the meeting, the Directors' report and the accounts were taken as read.

The CHAIRMAN, in moving their adoption, said the tale he had to tell on this occasion was not a long one. In regard to the sales of gas, the business of the undertaking was, he was glad to say, recovering from the severe set-back it experienced from the outbreak of the war. It would be remembered that just previous to that time they had to all appearances entered upon a period of comparative prosperity; the first half of the year 1914 having shown an increase of about 13 p.ct. In the following year, the increase dropped to 3·09 p.ct.; while in 1916 there was a reduction of 10·29 p.ct. Last year, however, the reduction was very much less—viz., 3·78 p.ct. This showed that the tide had once more turned in the Company's favour—in fact, since about the middle of the year, there had each month been more or less substantial increases; and these had continued down to the date of their latest returns that had come to hand. The significance of this welcome change was apparent from a large addition to the number of cooking and heating appliances in use, notwithstanding a reduction during the year in the actual number of consumers, although in this respect it was satisfactory to be able to say that the latest information was encouraging. He was sure it would be felt that this improvement, coming as it had done at the end of nearly four years of world-war, was distinctly reassuring, not only as to the immediate future, but also as to the post-war prospects of the undertaking. It was, moreover, apparent from the accounts that the financial position continued to be unimpaired—if, indeed, it might not be claimed to have been in some respects slightly improved. At any rate, the three reserves—viz., the reserve account, the insurance fund, and the contingency account—all remained at the same amounts at which they stood at the end of the fateful year 1914; while on the credit side of the balance-sheet, the last item was a sum of £10,000 placed on deposit at the bank. It was true that the Company were at the same time indebted to the bank to the extent of £9500; but this represented, among the British, Colonial, and Foreign stocks owned by the Company, £10,000 of last year's War Loan issues for which they subscribed in the full belief that this had the shareholders' entire approval. It was true also that the Company's indebtedness at Monte Video had somewhat increased, which was partly due to their having to obtain supplies locally to a greater extent than formerly; and partly also to provision having had to be made to meet the cost of certain necessary repairs which could not be effected until the end of the war. On the other hand, however, the comparative smallness of the expenditure on capital account bore evidence of nothing having been spent in this direction that could possibly be avoided; while the usual amount had been written-off for depreciation in compliance with a long-standing rule of the Company, which, it was much to be hoped, nothing would interrupt or disturb. The first item under the heading of stocks contained a reference which told its own tale of the stress of war conditions; the fact being that, owing to great and increasing difficulty in obtaining adequate supplies of coal, they had had to resort to the use of wood as a partial substitute. It was, however, a great relief to be able to say that, after unremitting effort—mainly, it was but just to add—on the part of Mr. Kearns, a further small shipment of coal had recently been secured; and it was very gratifying to know that the Government authorities, to whom they were greatly indebted for their assistance at all times with regard to shipments of materials, were doing all they could to help the Company in a matter of such vital importance to the carrying on of the business of the undertaking. He need hardly say that their difficulties in this respect were not less than they were last year—in fact, they were much greater; and unfortunately the end of them was not yet in sight. So far, however, they had been successful in keeping things going; and it would be through no want of endeavour on the part of the Board if they did not continue to do so until the return of more normal conditions. As was to be expected from the higher prices that had ruled for nearly everything connected both with gas manufacture and general engineering—coal, freights, iron, steel, and other materials—working costs had increased by £5971, as compared with those of the previous year, while at the same time the receipts from all sources were £1525 less. Thus the balance of revenue account was £19,165, compared with £26,672, which was the amount earned the previous

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year, showing that the trading profit was less by (roughly) £7500. This, however, was more than made up by differences in certain items, usually appearing in the profit and loss account, on which there was a saving in the three items, taken together—income-tax, depreciation of investments, and bad and doubtful debts—of £3146, and on the other side an increase in the profit on exchange and receipts for interest and discount, also taken together, of £5950. Both sums were in comparison with the previous year, and made together a total of £9096 to be added to the profit on trading account. There was thus a total available profit sufficient to pay the final dividend as recommended, making 3 p.ct. for the year, and to carry to next year's account £17,699, or £3005 more than was brought forward from the previous year. In times like the present, it might be counted as something to be able to add this moderate amount to what might be called the first line of defence, even though made possible by the profit and loss items to which he had referred, and not by any redundancy of trading profit. The Chairman concluded by referring to the important work which the Company's Dock Department are now carrying out for the Government of Uruguay.

Mr. JOHN MEWS seconded the motion, which was unanimously agreed to.

Proposed by the CHAIRMAN, and seconded by Mr. FRANK H. JONES, a dividend was declared of 6s. per share (less income-tax), making, with the interim payment of like amount, 3 p.ct. for the year.

Proposed by the CHAIRMAN, and seconded by Mr. F. W. CHURCH, the retiring Directors (Mr. Frank H. Jones and Mr. W. E. Horne, M.P.) were re-elected; and subsequently the Auditors (Mr. Laurence E. Halsey and Mr. William C. Sneath) were re-appointed, on the proposition of Mr. A. J. KINGDON, seconded by Mr. C. HOLMES HUNT.

The CHAIRMAN proposed that the best thanks of the meeting be given to the whole of the staff of the Company for their services during the past year. He was sure the shareholders would admit that at no time had their thanks been more deserved than they were now. Their staff were passing through extremely trying times; and he need not say that they had been most loyally supported by all the staff both here and at Monte Video. He had referred to the indefatigable services of Mr. Kearns in getting shipments of the various needful materials—particularly coal.

Mr. JONES remarked that, personally knowing the work of their staff, he had much pleasure in seconding the motion. Though Mr. Kearns appreciated this recognition very much, he (Mr. Jones) knew it was very deeply appreciated also by their Manager and the staff in Monte Video.

A hearty vote of thanks was also passed to the Chairman and Directors, on the motion of Mr. CHURCH, seconded by Mr. KINGDON.

Price of Gas at St. Helens.—The St. Helens Gas Committee have decided that it will be necessary to increase the price of gas 5d. per 1000 c.ft., making it 3s. in the borough.

AUSTRALIAN GASLIGHT COMPANY.

At the Half-Yearly Meeting of the Company—which was held in Sydney on March 21, under the chairmanship of Mr. GEORGE J. COHEN—it was reported that the profits for the half year ended Dec. 31 last (including the balance brought forward) amounted to £43,014; and out of this the Directors recommended the payment of a dividend for the six months of 2½ p.ct. on the "A," "B," and "C" shares, leaving to be carried forward a sum of £4764.

The CHAIRMAN, in moving the adoption of the report and accounts, said the principal event since the last meeting had been the passing by the Legislature of an amendment of the Gas Act of 1912. It had for some time past been patent to the Directors that, unless the Act was amended, it would be impossible to raise the further capital which was required to enable the financial position of the Company to be placed on a satisfactory footing, and to enable the Company to provide the extensions for which there was an ever-increasing demand. The Government, after having the position explained to them, recognized that the claims of the Company were founded on justice; and so they agreed to introduce an Amending Act. Under the Gas Act of 1912, the Company were entitled to have the standard price of gas increased in accordance with any increase in the cost of labour; but they were not entitled to have the standard price increased if the cost of coal, oil, freight, rates, and other expenses—which, of course, were beyond the control of the Company—increased above the cost when the Act was passed. Large increases had occurred in all these items; and the Amending Act allowed these increases to be taken into account. However, the Act provided that the increased costs must be proved to the satisfaction of a Supreme Court Judge. At the same time, the Government adopted the attitude that, if the gas companies wanted assistance, they must, in this time of war, when so many were suffering in various ways, be prepared to make some sacrifice in the interests of the public; and so they insisted that the standard rate of dividend on the "A" and "B" shares must be reduced from 10 to 8 p.ct. In comparing the revenue account for the past half year with the corresponding period of 1916, the expenditure showed an increase of over £41,000, which was more than accounted for by the increased cost of coal. There had been an increase in the revenue derived from the sale of gas and residuals to the extent of £20,000; the net result being an increase in the half-year's expenditure of about £21,000. The railway and tramway strike in August last led to the Company's men going out in sympathy; but owing to the assistance rendered by the Government, the Company's staff, and a band of loyal workers, they were able to maintain the supply of gas during the whole period, though at first only on a limited scale. The patriotic action of these loyalists was greatly appreciated. A considerable number of those who volunteered their services during the crisis were still in the service of

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the Company, and doing good work. The policy of the Company in keeping a good supply of meters in stock had proved a sound one; for, notwithstanding the long duration of the war, it was only now that the inconvenience was being felt. It was a curious fact that in 1840—the commencement of the Company's career—gas was sold on a flat rate; and this system continued for ten years, when meters gradually came into general use. No. 4 retort-house at Mortlake had now been completed with materials obtained locally. The head station had now been closed-down as regarded the manufacture of gas. Various extensions at Mortlake, to cope with the anticipated growth of the Company's business, were being carried out; and at no distant date another retort-house would have to be erected, for which additional capital would have to be provided. Reverting to the Gas (Amendment) Act, 1918, he would like to point out that, though the old Act provided for a 10 p.ct. dividend on the original, and 7 p.ct. on the new capital, the standard price of gas was fixed too low to allow of these rates being paid. This naturally seriously affected the market value of the shares. Though the Directors felt considerable disappointment at the standard rate of dividend being fixed at 8 p.ct., it was hoped that one of the effects of the new Act would be to restore confidence in the Company's shares as a satisfactory investment. The powers conferred by the Act stipulated for an 8 p.ct. dividend on the ordinary shares, and 7½ p.ct. on the preference shares. The Government included in the Amending Act a new section providing for a reduction in the number of Directors from twelve to seven. In consequence of the many disabilities under which the Company had laboured during the past half year, the progress had not been so great as one could wish, but the number of consumers had increased by 1282—the total number to date being 139,611. The Directors greatly regretted the inconvenience caused the general public through the shortage of meters, arising from the restrictions upon exportations from England; and, after much deliberation, it had been decided, where necessary, to adopt what was known as the flat-rate system of gas supply to meet the demands of would-be consumers. This would be a temporary arrangement only. There were a great number of applications for extensions in hand, which had had to be held over pending the obtaining of additional capital. The Company's Roll of Honour now contained 316 names; but, unfortunately, 31 had made the supreme sacrifice for the Empire.

Mr. W. C. GODDARD seconded the motion, which was carried unanimously.

On the motion of Mr. R. A. ARNOLD, seconded by Mr. F. W. WALKER, a vote of thanks was accorded the Directors, the Secretary (Mr. R. J. Lukey), the Acting Engineer (Mr. Andrew Wilson), and other officers, for their efficient management of the Company's business during the half year.

In presenting the annual local "Budget" statement to the Bradford City Council last week, Mr. Stringer said the Finance Committee had spent £5500 less than estimated; £5400 of this decrease being due to the reduced public lighting.

BRIGHOUSE GAS-WORKS RESULTS.

In his annual report to the Brighouse Corporation Gas Committee, Mr. H. Davies (the Engineer and Manager) states that the output of gas for the year ended March 31 shows an increase of 2,715,000 c.ft., or 1·81 p.ct.; while the gas sold increased by 3,871,300 c.ft., or 2·83 p.ct. The unaccounted-for gas now stands at 7·03 p.ct., compared with 7·92 p.ct. last year.

Slot-meters again show a substantial increase in gas consumption; and the extent to which their usefulness is being developed is indicated by the continued rise in the average consumption, which this year has reached 13,111 c.ft., as compared with 12,190 c.ft. last year. Of the gas sold, 27·32 p.ct. passes through slot-meters; and this represents the handling of nearly 14 tons in weight of pennies.

The average make of gas per ton of coal was 11,202 c.ft., and the gas sold per ton 10,325 c.ft.; and for the class of fuel, and the type of plant in which it is carbonized, this result is very satisfactory. The yield of residuals was again exceptionally good, and the value naturally shows an increase, which covered half the increased cost of the coal. They realized a net amount equivalent to 77·34 p.ct. of the total cost of the coal.

The cost of coal shows an average increased price of 2s. per ton over last year, one-half of which has been borne by the residuals, and the other half by the consumers of gas, to whom charges were increased from Oct. 1, by 3d. per 1000 c.ft. Wages accounts increased £1142 during the year, or nearly 30 p.ct., equivalent to 2d. per 1000 c.ft. of gas sold. The average price received per 1000 c.ft. of gas sold was 2s. 9·73d.; the net profit being 3·17d.

On the year's working, the accounts show a gross profit of £6613, and a net profit of £1859.

A SYMPOSIUM ON GAS FOR HOUSE HEATING.

A leading feature in a recent number of the "American Gas Engineering Journal" was a symposium comprising the views of recognized authorities on the exclusive use of gas for house heating. Mr. Jacob D. von Muir, the Distribution Engineer of the Laclede Gas Light Company, St. Louis (Mo.), refers to the importance of maintaining as nearly as possible a uniform load throughout the year, and remarks that a large house-heating business would give trouble by adding to the demand during the heaviest periods—instancing the past winter's experience as illustrating the effect of a prolonged spell of cold weather on the consumption of gas, even in the absence of any unusual amount of heating business. He asks what might have been expected in a district where extensive house heating was in existence, at a time when many were unable under ordinary circumstances to keep pace with the demand; and he suggests that main efforts should be directed towards a less proportion of idle plant at the gas-works during the summer

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months. The object should be to fill up the valleys, rather than add to the height of the peak-loads, as every addition to these meant extensions at the gas-works. But public demands must be satisfied; and it was more a question of what would have to be done, rather than the selection of profitable lines. The customers who increased the height of the "peak" should pay in proportion. Gas companies could not take on a line of business that reduced the profit on the year's operations; and consumers could not expect to be served at less than a fair cost of service. If new conditions added to the maximum output, corresponding increase would be necessary at the gas-works; and the investment in additional plant should be considered when fixing the price of gas.

The President of the American Gas Institute (Mr. A. E. Forstall) bluntly declared that the successful pushing of gas for house heating may be a national duty, but would not be profitable to gas companies, unless some advance was made on the ordinary price of gas.

Mr. E. C. Jones (Pacific Gas and Electric Company, San Francisco) urged that the pushing of house heating was not only a national duty, but also a sound commercial policy. After very many years' devotion to the industry, he realized its boundless possibilities, and deplored lack of enthusiasm and faith in it.

Mr. E. N. Wrightington (Vice-President of the Boston Consolidated Gas Company) was not enthusiastic about the exclusive heating of houses with gas, under local climate and conditions. He believed in gas heating as an auxiliary, or for intermittent use in the spring and autumn.

METER-MAKERS' WAGES IN SCOTLAND.

Award of the Committee on Production.

The parties to the reference were the Gas-Meter Making Employers' Federation, Scotland, and the United Journeymen Brassfounders' Turners, Fitters, Finishers, and Coppersmiths' Association, the Amalgamated Instrument Makers' Society, the Navvies, Builders' Labourers, and General Labourers' Union, the National Union of General Workers, and the Workers' Union. The claim was for payment of a bonus of 12½ p.ct. on earnings to plain-time workers, and 7½ p.ct. on earnings to piece workers in the employ of the firms belonging to the Federation, in accordance with the terms of the award of the Committee on Production of March 19, 1918 [Sheet Metal Workers in Gas-Meter establishments]. The award does not apply to plain-time workers who are within the terms of Order No. 1061 (Statutory Rules and Orders, 1917), or who are engaged in engineering shops, boiler shops, or foundries, or in other establishments to which Order No. 1301 has been applied by any Order of the Minister of Munitions under his statutory powers; such workers being already entitled, under those Orders, to the 12½ p.ct. bonus

The award is that the men concerned, aged 21 years and over, who are paid as plain timeworkers, shall receive a bonus of 12½ p.ct. on their earnings, which shall not alter or become part of their time rates. This shall not apply to any workmen in receipt of any allowance or bonus other than (*a*) an allowance or a bonus wholly independent on timekeeping, (*b*) an allowance or a bonus (not being a bonus on output) less favourable to the men than the advance of 12½ p.ct. hereby awarded, in which case the existing allowance or bonus shall merge in the 12½ p.ct., or (*c*) war advances given to assist in meeting the increased cost of living since the outbreak of the present war.

The men concerned aged 21 years and over who are pieceworkers, or are paid on a premium bonus system or any mixed system of time and piece, or any system of payment by results, including men working at augmented time rates fixed in lieu of piece rates, or by reference to results or to output of work, shall receive a bonus of 7½ p.ct. on their earnings. Any bonuses or war advances which, in the case of timeworkers, have merged in the bonus of 12½ p.ct. granted to timeworkers under Orders Nos. 1061 and 1301 shall, in the case of pieceworkers, merge in the 7½ p.ct. bonus. The bonuses shall be payable from the beginning of the first full pay after Jan. 1, 1918. If any payment has been made to the workmen concerned pending the general consideration of their position in relation to the bonus of 12½ or 7½ p.ct., whether by agreement or as a result of arbitration, the amount of such payments shall merge in the bonus now awarded; and such bonus shall be in lieu of, and in substitution for, any other payment.

The award does not apply to workmen paid a wage or salary not dependent on time worked, or an upstanding wage or salary which covers overtime or other allowances.

AFTER THE WAR PROBLEMS.

Gas Engineering Represented on the Reconstruction Council.

In connection with the formation of the Industrial Reconstruction Council in Manchester among local engineers and trade union leaders, several private conferences have recently taken place, on the invitation of Captain Mather, of Messrs. Mather and Platt, Ltd. A general statement on the formation of the Council states that the three main objects in view are (1) to provide facilities for personal intercourse between employers and workers; (2) to furnish opportunities for general discussion; and (3) to carry out constructive investigation and study of the conditions and problems affecting the working of the engineering industry. The Council will undertake no negotiations; and members will participate in its work as individuals, not as delegates of other organizations.

The gas engineering representative on the Council is Mr. Fred J. West, of West's Gas Improvement Company, Ltd. Mr. L. E. Mather has been appointed Chairman.

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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *May* 17.

In view of the lateness of the season, there is quite a considerable amount of activity in the pitch market. The whole position of this article is unchanged; the price being firm at not below 55s. per ton net at makers' works. For next season also continued interest is displayed; and, if anything, higher prices are looked for. A moderate amount of business is being done in solvent naphtha; the price for prompt delivery being at about 4s. 3d. per gallon net at makers' works. In other tar spirits there is no change. Creosote, tar oils, and fuel oil continue in demand at the prices fixed by the Ministry of Munitions. Anthracene, 48-50 p.ct., is 6d. per unit net, casks free.

There is a considerable amount of inquiry for sulphate of ammonia under the terms of the new Government order.

FROM A MARKET CORRESPONDENT.

Tar Products.

The condition of markets has changed very little since my last report. Pitch remains an interesting product in anticipation of some official uniform price fixation. It is generally agreed, however, that this would be a matter of some difficulty in view of the present differing quotations in various Provincial centres. London quotes 55s., although export business is on the dull side. South Wales reports transactions at 38s. to 40s. per ton, and other Provincial rates range from 27s. to 32s. Manchester stands to benefit materially by any official fixing of prices, and quotations there are accordingly very firm. Tar is well maintained and in good demand. Benzol and toluol continue in heavy request for munitions purposes, and makers are urged to produce to their utmost capacity. Carbolic acid and creosote also go into consumption practically as fast as produced. The latter is 75s. per ton, equal to 4½d. per gallon—there being an average of 214 gallons, or thereabouts, to the ton. Solvent naphtha is still dull in Provincial centres, although in rather better request in London at 4s. 6d. The restrictions as to sale for delivery beyond the end of June are still in force, and the trade is in a difficulty with regard to future business in view of possible further regulations and price restrictions. Heavy naphtha is steadily held for 3s. 3d. per gallon generally. Naphthalene is rather heavy, especially crudes, which make from £5 10s. for low grades up to £13 for better qualities. Refined still sells at £30. Cresylic acid is rather better at 3s. 6d. to 3s. 9d. per gallon, casks included. Anthracene and aniline oil are unchanged. The range of quotations is as follows:

Benzol: 90% London, 1s. 0½d., North 10½d. to 11½d.; 50% North 1s. 4d. to 1s. 5d. naked per gallon.

Carbolic Acid: 60% East and West Coast 3s. 6d. per gallon; crystals 40% 1s. 3d. per lb.

Crude Tar: London 32s. 6d. to 35s. Midlands 27s. to 29s.; North 28s. to 30s. per ton, *ex* works.

Pitch: London 55s. f.o.b.; East Coast, 30s. to 32s. f.o.b.; West Coast, 28s. to 30s. f.a.s.; Clyde 29s.; South Wales 38s.

Solvent Naphtha: Naked London 90-190% 4s. 6d.; North 3s. 9d. to 4s. per gallon; 90-160% naked London 4s. 3d. to 4s. 6d.; North 4s. to 4s. 3d. per gallon.

Crude Naphtha: Naked 30% 8¼d. to 8½d.; North 6¼d. to 6½d.

Naphthalene: Refined £30 to £32 10s.; salts 80s., bags included.

Toluol: Naked, London 2s. 4d.; North 2s. 3d.

Creosote: Nominal, London 4¼d.; North 4d. to 4¼d. (Government price, 75s. per ton f.o.b.—equal to 4⅝d. per gallon); heavy oil, 4½d. per gallon in bulk.

Anthracene: "A" quality, 40-45%, 4½d. per unit; "B" quality, 1¾d. to 2¼d.

Cresylic Acid: 95%, 3s. per gallon; 97-99%, 3s. 3d. to 3s. 6d. per gallon, casks included *ex* works London and f.o.b. other ports.

Grease Oils 18° Tw. (naked) £6 per ton f.o.r. makers' works.

Sulphate of Ammonia.

Considerable interest still centres on the recently fixed prices for next season. It is urged in some quarters that £17 7s. 6d. per ton will hardly recompense some makers for their increased expenditure on plant and the heavy additions in the cost of production. On the other hand, this price is some £2 7s. 6d. per ton higher than the average of the current season; and it is open for any maker who feels he has a grievance with the new prices to take his case before a special commission which deals with such things. Makers are interested further in the synthetic process, which has been officially adopted; and inquiries are being made as to the size of plant and cost of production. They are, however, hardly likely to be satisfied on these points.

Increased Wages at Oswaldtwistle.—At the last meeting of the Oswaldtwistle District Council, the Gas Engineer (Mr. J. H. Davies) reported that he had an application from the stokers for an interview on the question of wages. The men asked for an advance which would bring their pay to £1 a week over pre-war rates; but eventually they proposed that they should be granted an advance of 2s. 8d. per day, making their wages 18s. 8d. over pre-war terms. It was resolved that the proposed advance be agreed to for the period of the war and for three months after; and that it be retrospective as from Jan. 1 last. It was decided that, in the event of any abnormal advance on present prices of food, the question of a further advance would be considered, but not otherwise; and that the other employees at the gas-works be granted an advance of 5s. per week on present pay.

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Gas and Meter Testing at Portsmouth.

In his annual report, the Gas Examiner informs the Portsmouth Corporation that, of 3086 meters tested, 2698 were correct, 129 fast, 81 slow, 69 would not work, 33 were leaking, and 77 were rejected for various defects. A large number of complaints had been received from consumers; but very little fault had been found with the meters, the error on the lost side rarely exceeding 5 p.ct. He is afraid that the lower heat value of the gas has had more to do with the increased consumption than any error in registration on the part of the meters. Dealing with the results of the testing for the calorific value of the gas, he says that since proceedings were taken the quality has been slightly higher; but the standard is not maintained, though the deficiency is less. With regard to purity, there has been no cause for complaint; and the pressure has been well maintained. If the rationing of gas is proceeded with, some pressure should be brought to bear on the Company to secure a better value, as few consumers will be able to reduce their consumption by one-fifth unless better heat value can be obtained.

Increased Consumption at Heywood.—At the last meeting of the Heywood Town Council, Mr. Walter Whatmough (the Gas Engineer) reported that the consumption of gas for the year ended March 31 was 139,095,000 c.ft., as against 136,566,000 c.ft. the previous year.

Salford Gas Committee and the Rates.—Some criticism was levelled at the contribution of £10,000 by the Salford Corporation Gas Committee to the relief of the rates, at a special meeting of the Town Council last Wednesday passing the annual estimates and approving an increase of 1s. 6d. in the pound on the rates. Alderman Jenkins (the Chairman of the Finance Committee) explained, however, that the amount referred to was fixed by Act of Parliament.

Charges for Carting Coke Increased.—Owing to the increased cost of animal feeding-stuffs and of wages, a number of gas undertakings in Lancashire have been compelled to increase their charges for carting coke. At the last meeting of the Oswaldtwistle Gas Committee, the Gas Engineer (Mr. J. H. Davies) brought this matter forward; and in the result it was resolved that the minimum charge for carting coke be increased to 2s. 6d. per ton—an advance of 10d.

Doncaster Wages Award.—The award to the Doncaster Corporation employees, who were recently on strike, was received in the town last week. Men of 18 years of age and over whose increases or bonus do not already exceed 13s. a week above pre-war rates, receive 5s. per week, and those whose existing increases are over the 13s. mark get 4s.; women of 18 or over receive 5s.; youths and girls get 2s. The advances date from the first pay day in March. They apply to persons up to 63 years old. Advances beyond this are subject to mutual agreement between the Corporation and the Labourers' Union.

The Lighting and Heating Order.—The Westminster City Council, at their meeting last Thursday, on the suggestion of the St. Pancras Borough Council, adopted the following resolution, and agreed to forward it to the Board of Trade: "That this Council are of opinion that the Lighting, Heating, and Power Order, 1918, inasmuch as it restricts every consumer by one-sixth without providing an adequate minimum for both lighting and cooking, is inequitable and inadvisable, and calculated to press unfairly on the poor and patriotic consumer who has already reduced his amount to the smallest fitted to meet the ordinary exigencies of life."

Bombay Gas Company, Ltd.—The profit of the Company for the year ended Dec. 31 last, as shown by the net revenue account, after allowing for interest and exchange, amounts to £30,534, making, with £16,933 brought forward from the preceding year, £47,467 available for dividend. Deducting the interim dividend (£9800), and placing £1246 to the reserve fund, £5064 to the renewal fund, and £139 to the insurance fund, there remains £31,218, out of which the Directors recommend a dividend of 4½ p.ct. (less income-tax), making 8 p.ct. for the year. This will leave £18,618 to be carried forward. The meeting will be held on Thursday, the 30th inst.

Gas Secretary and Protection.—At a sitting of the East Sussex Appeal Tribunal, the Bexhill Gas and Water Company appealed against the finality imposed by the local Tribunal on the exemption of their Secretary (39), Grade 1. The Secretary said he managed all the details of the Company. The nearest Director lived in London. He had not trained anybody to take his place in the event of his going, nor had the Company sought anyone, as they had been given to understand, by the decisions of the local Tribunal, that he was safe; and, moreover, he regarded himself as in a scheduled occupation. Major Grantham urged that a certificate of protection should be obtained. The word "final" was eliminated by the Tribunal, who decided that the Secretary was in a scheduled occupation. Leave was given to appeal to the Central Tribunal.

Manchester Gas Committee's Annual Estimates.—Budget Day of the Manchester City Council last Wednesday did not arouse much enthusiasm; interest being chiefly centred in the annual estimates of the trading committees. In the result, these were accepted without criticism, as was the Finance Committee's proposition that the general rate should be increased by 1s. 5½d. in the pound, this being due largely, not to increased expenditure by the trading committees, but to war bonuses and allowances to nearly 7000 Corporation servants, representing not far short of the estimated expenditure of the Gas Committee for the year ended March 31, 1919, of over a million pounds sterling. Alderman Wm. Kay, J.P. (the Chairman of the Gas Committee) formally moved the gas estimates be accepted. These take credit for an income of £1,161,000, or £10,511 less than the actual figure last year. The estimated expenditure, including provision for renewals and debt charges, amounts to £1,192,152 and is more than last year's actual expenditure by £150,758. This shows a deficiency at this point of £31,152, which, with the amount of expenditure of a capital nature to be paid for out of revenue account (estimated at £7500), makes a total of £38,652 to set against the credit balance of £49,666 brought from last year.

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Cost of the Wages Award at Rochdale.—It was reported to the Rochdale Corporation Gas Committee last Wednesday that the recent award to certain gas workers would cost the department in extra wages and war bonuses £5000 a year. The award was 4s. on wages, and a bonus of 12½ p.ct. on top of this.

Gas Undertakings and Concentrated Liquor Prices.—Referring to the recent conference in London with the Ministry of Munitions and the Food Production Committee with regard to an increase in sulphate of ammonia prices [*ante*, p. 246], Mr. S. Meunier, the Gas Engineer, informed the Stockport Town Council at their last meeting that he was in communication with other gas engineers, with a view to concerted action being taken to obtain an increased price by gas undertakings supplying concentrated liquor to the Government.

A Faulty Gas-Tap.—A sad double fatality, found by the Coroner's Jury to be due to a defective gas-bracket, has occurred at a small Liverpool hotel. A coal miner and his wife had been to visit a wounded son, who was an inmate of one of the city hospitals; and on the following morning they were both discovered dead in their room, which had no chimney, and was full of gas. The porter at the hotel said the tap was without a stop-pin, so that there was nothing to prevent its being turned right round. All the gas-fittings in the house were stated to be in a very bad condition.

Co-operation of Gas and Electricity at Walsall.—The Walsall Corporation having asked the Gas and Electricity Committees to confer as to the best way of co-operating to meet the increased demand for power and lighting and the best and most economical way, a Joint Committee of two Committees report an agreement that if one department were asked to give a supply for which either gas or electricity was equally suitable, and such supply could not, with due regard to the economy necessary during the war, be given by that department, the inquiry should be referred to the other department.

Coal Consumption Economy and Production.—The Board of Trade announce that, in view of the importance of economizing in the consumption of coal and other fuel supplies, special attention has been given by the Government to the possibility of securing concentration of production in industries in which restriction of output has caused an uneconomical use of fuel. Last week, Mr. Guy Calthrop met the Scottish Coal Trade Conciliation Board in Glasgow, to consider what could be done to increase the output of coal, in view of the combing-out of the miners for the army. The Controller was assured by both parties that they would do everything to assist him in the present emergency. The Coal Controller having made a request to the Leicestershire miners to confine their Whitsuntide rest to two days, the men agreed to do so.

STOCK MARKET REPORT.

THE Stock Exchange wound up with quite a cheerful week in advance of the Whitsuntide vacation. All took it as a matter of course that business should become "fine by degrees and beautifully less" as day by day progressed towards the closure. This being accepted as a normal and inevitable factor, all others that might have an element of uncertainty were happily propitious, and the ruling tone was quite satisfactory from start to finish.

The gilt-edged market was, as for some time past, on the top of the tide. The demand for all the best things was persistent, and the supply of stock was insufficient to meet it. Government issues of all sorts—Home, Indian, and Colonial—were very strong, and War Loans steadily strengthened. Home Rails improved upon their previous week's figures; prior charges being especially in request.

The Foreign Market was in excellent case. The most conspicuous were French, Japanese, Chinese, Brazilian, and Chilian; but Russians were not supported. Argentine Rails were rather firmer, and some Canadians advanced in anticipation of acquisition by the Government. Miscellaneous undertakings were quiet.

Business in the Gas Market showed a fair improvement in point of the volume of transactions; thus confirming the indications of the week before. The three largest undertakings, however, had more than the lion's share of the business. The general tone was quite satisfactory. Imperial Continental was most prominently in evidence, and made a free advance; the outlook as presented at the general meeting being encouraging. Gas Light and Coke was quite firm, and South Metropolitan made a recovery.

In the Money Market, rates at first were firm, but easier terms prevailed later.

Bargains done for cash during the week were as follows: On Monday, Bournemouth "B" 10½, Cape Town debenture 60, 64, Gas Light ordinary 65, ditto preference 69, ditto debenture 56, 56¼, Imperial Continental 85, 86¼, 86½, 86¾, Malta and Mediterranean 3⅜, Metropolitan of Melbourne 100. On Tuesday, British debenture 67, Gas Light ordinary 64¼, 64½, 64⅜, 65, 65¼, ditto maximum 53¼, 53½, ditto preference 68½, ditto debenture 55⅜, Imperial Continental 86½, 86⅜, 87, ditto debenture 66½, Primitiva 34s. 3d., South Metropolitan 64, 64½, 65, Danish 60, 60½. On Wednesday, Brentford "B" 72, 72½, Brighton and Hove original 140, Gas Light ordinary 64½, 64⅜, 65, ditto preference 68¼, Imperial Continental 86, 86½, 87, 87⅛, 87⅜, ditto debenture 66½, 66⅜, 67, Primitiva debenture 76½, 77, South Metropolitan 64, 64¼, 64½, 64⅜, 65, Tottenham debenture 63, Monte Video debenture 80. On Thursday, Bournemouth "B" 11, Brighton and Hove original 130⅜, Gas Light ordinary 64, 64⅛, 64½, 64⅝, 65, ditto maximum 54½, Imperial Continental 86½, 87½, 88, 88½, South Metropolitan 64½, 65, South Suburban 69, Tottenham "A" 90, ditto "B" 67½, 68, ditto debenture 63½, Lewes 86, 86½. On Friday, Bombay 5 7/16, Brentford "B" 72, 72½, Brighton and Hove original 138, 139, 139⅜, British debenture 67, Gas Light ordinary 64, 64¼, 64½, 64⅜, 65, ditto debenture 55½, Imperial Continental 87½, 88¼, 88½, South Metropolitan 64½, 65, South Suburban, West Kent, 60, 60½.

The Bank rate is 5 p.ct., as fixed on April 5, 1917.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Share.	When ex-Dividend.	Ante-War Dividend & Bonus p.c.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
175,472	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	55—60	..
1,551,868	"	April 8	2½	4⅜%	Alliance & Dublin Ord.	59—64	50—55	..
374,000	"	July 10	4	4%	Do. 4 p.c. Deb.	76—79	58—63	..
280,000	5	April 29	7½	8%†	Bombay, Ltd.	5⅛—6⅛	5¼—5⅝	5 7/16
50,000	10	Feb. 26	16	13%	Bourne- (10 p.c.	29—30	21—23	..
883,110	10	"	7	7%	mouth Gas (B 7 p.c.	15—15½	10½—11	10½—11
115,000	10	"	6	6/-	and Water (Pref. 6 p.c.	13½—14	9—9½	..
159,740	—	—	—	4%	(4 p.c. Deb.	..	67—69	..
992,045	Stk.	Feb. 26	14	4½%	Brentford A Consolid.	261—266	76—79	..
734,920	"	"	11	4½%	Do. B New	204—209	70—73	72—72½
65,000	"	"	5	5%	Do. 5 p.c. Pref.	109—111	79—84	..
221,400	"	June 11	4	4%	Do. 4 p.c. Deb.	91—93	63—65	..
217,380	"	Feb. 26	11	9%	Brighton & Hove Orig.	208—213	135—140	138—140
244,200	"	"	8	6%	Do. A Ord. Stk.	154—159	95—100	..
530,000	20	Mar. 26	12½	22/6	British	44—45	31—32	..
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	65—67	67
245,771	"	"	4	4%	Buenos Aires 4 p.c. Deb.	85—87	51—54	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	3½—3⅝	..
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	7—8	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	58—63	60—64
157,150	"	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	79—81	..
1,513,380	"	Feb. 12	5/9/4	41/4	Commercial 4 p.c. Stk.	106—108	64—66	64½
560,000	"	"	5½	36/8	Do. 3½ p.c. do.	103—105	62—64	..
475,000	"	June 11	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	52—54	..
800,000	"	"	4	—	Continental Union Ltd.	76—79	30—35	..
200,000	"	"	7	—	Do. 7 p.c. Pref.	115—118	60—62	..
278,400	—	—	—	11½%	Croydon B and C 7 p.c.	..	150—160	..
—	—	—	—	10%	Do. E	..	..	..
492,270	Stk.	—	6	5½%	Derby Con. Stk.	123—126	95—100	..
55,000	"	—	4	4%	Do. Deb. Stk.	102—104	80—83	..
1,002,180	10	July 29	10	5/0	European, Ltd.	17½—18	7—8	..
16,298,975	Stk.	Feb. 10	4/17/4	37/4	Gas (4 p.c. Ord.	98—102	64—66	64—65½
2,600,000	"	"	3½	3½%	Light (3½ p.c. max.	76—79	53—55	53¾—54½
4,062,235	"	"	4	4%	and (4 p.c. Con. Pref.	96—99	68—70	68¾—69
4,674,850	"	June 11	3	3%	Coke (3 p.c. Con. Deb.	72½—74½	55—57	55½—55¾
130,000	"	"	10	10%	(10 p.c. Bonds	..	..	..
258,740	"	Mar. 12	5	3½%	Hastings & St. L. 3½ p.c.	87—89	46—51	..
70,000	10	April 29	11	6%	Hongkong & China, Ltd.	16½—16⅞	7¾—8⅛	..
86,600	—	—	—	9½%	Hornsey 7 p.c.	..	115—125	..
131,000	Stk.	Mar. 12	7½	7%	Ilford A and C	151—154	90—95	..
65,780	"	"	6¾	5½%	Do. B	115—118	70—75	..
65,500	"	June 26	4	4%	Do. 4 p.c. Deb.	92—94	63—66	..
4,940,000	"	May 14	9	4½%	Imperial Continental	150—160	67—69	85—88½
1,235,000	"	Feb. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	65—68	66½—67
235,242	"	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	82—87	..
2,498,905	"	Feb. 26	10	5%	Liverpool 5 p.c. Ord. (A	211—213	82—84	..
					(B	146—148		
306,088	"	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	71—73	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅜	3⅝—3⅞	3⅜
250,000	100	April 1	4½	4½%	Met. of (4½ p.c. Deb.	99—101	88—99	100
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	8—8¼	..
1,875,892	Stk.	July 29	4½	3⅛%	Newcastle&Gatsh'd Con.	98½—99½	69—71	..
529,705	"	June 26	3½	3½%	Do. 3½ p.c. Deb.	82—83	63—64	..
55,940	10	Feb. 26	7/14/0	7%	North Middlesex 7 p.c.	14—15	9¼—10½	..
300,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	101—103*	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅝	2—3	..
60,000	50	Feb. 26	13	10%	Portsea, Island B	125—131	82—87	..
100,000	50	"	12	9%	Do. C	118—121	72—77	..
52,000	50	"	10	7%	Do. D	..	..	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	1⅝—1⅞	34/3
499,960	5	June 26	5	2/6	Do. 5 p.c. Pref.	4⅝—5	2⅝—2¾	..
521,600	100	June 2	4	4%	Do. 4 p.c. Deb.	91—93	76—78	76½—77
—	—	—	—	4%	Do. " " 1911	..	..	..
346,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	85—87	57—62	..
150,000	10	May 14	6	6/-	San Paulo (6 p.c. Pref.	10½—11	7½—7⅞	..
125,000	50	July 1	5	5%	(5 p.c. Deb.	47—49	40—42	..
135,000	Stk.	Mar. 12	10	10%	Sheffield A	223—224	..	..
209,984	"	"	10	10%	Do. B	222—224	174—177	..
523,500	"	"	10	10%	Do. C	220—222	..	..
90,000	10	May 28	9	6/-	South African	10½—11½	9—10	..
6,609,895	Stk.	Feb. 10	5/4/0	40/-	South Met. 4 p.c. Ord.	111—113	64—66	64—65
—	—	—	—	—	Do. Pref.	..	93—95	..
1,895,445	"	July 10	3	3%	Do. 3 p.c. Deb.	72½—74½	54—56	..
224,820	"	Feb. 26	8½	6%	South Shields Con. Stk.	157—159	129—131	..
952,795	"	"	6	4½%	S'th Suburb'n Ord. 5 p.c.	114—116	69—72	69
60,000	"	"	5	5%	Do. 5 p.c. Pref.	110—112	73—75	..
135,000	—	—	—	4½%	Do. West Kent	..	..	..
187,558	Stk.	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	84—86	60—60½
647,740	"	May 14	5	3%†	Southampton Ord.	99—102	74—76*	..
120,000	"	Feb. 12	7½	5½%	Tottenham (A 5 p.c.	135—138	90—95	98
782,275	"	"	6	4%	District (B 3½ p.c.	115—117	67—69	67½—68
181,255	"	June 26	4	4%	(4 p.c. Deb.	87—89	62—64	63—63½
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	60—65	..
236,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p.c. max.	108½—109½	87—88	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	"	Feb. 26	8⅜	67/6	Wandsworth A 5 p.c.	151—156	108—113	..
255,636	"	"	6⅝	52/6	Do. B 3½ p.c.	129—134	80—85	..
108,075	"	"	5/17/3	47/3	Do. C 3½ p.c.	110—115	80—85	..
352,000	"	"	6½	46/3	Wimbledon 5 p.c.	117—123	80—85	..
98,000	"	"	6⅝	52/6	Epsom 5 p.c.	121—126	80—85	..
88,416	..	June 26	3	3%	3 p.c. Deb. Stk.	66—69	49—52	..

* Ex. Div. † Next Dividend will be at this rate.

German Hydrogen Patents.—Mention was made in the "Journal" [*ante*, p. 199] of the fact that Messrs. Samuel Cutler & Sons were applying for licences to use six German patents for the manufacture of hydrogen gas. The application duly came before the Patents Court, when the Comptroller announced that, as the matter appeared of so great national and scientific interest, he should recommend the Board of Trade to grant the licences without delay.

The Lambeth Board of Guardians have considered at length the desirability of approaching the Board of Trade with a view to acquiring a special licence to permit them to have sufficient supplies of electricity and gas to meet their requirements. But before taking action in this direction, and in order to ascertain that strict economy is being exercised, they have instructed the chief officers of the institutions to submit a monthly return of the meter-readings.

A determined case of suicide by gas poisoning occurred at Nottingham last Monday week, when Jesse Freund, a Swiss subject, was found dead in her bedroom. She was sitting in a chair, with a tube from a gas-bracket in her mouth. A verdict of "Suicide during temporary insanity" was returned.

The Directors of the South African Lighting Association, Ltd., have resolved to pay a final dividend of 7 p.ct. for the half year ended Dec. 31 last (less income-tax at 5s. in the pound), making, with the interim dividend already paid, 10 p.ct. for the year 1917, as compared with 9 p.ct. for 1916. The dividend is subject to audit.

A Coroner's Jury, at Birstall, last week, returned a verdict of "Death due to inhaling coal gas while of unsound mind, brought on by a long and painful illness," in the case of Charlie Armitage (53), a clogger, who had been found dead in his workshop in High Street. He was lying on the floor with the gas-stove held to his mouth with both hands.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Engineer and Manager. No. 6449. Applications by May 25.
Secretary and Manager. Ripley (Derbyshire) Gas Company. Applications by May 29.
Manager (Gas and Water). No. 6453.
Assistant Manager. Inchgreen Gas-Works, Greenock.
Engineering and Chemical Assistant. Longton Gas-Works.
Chemist. Inchgreen Gas-Works, Greenock.
Assistant Chemist. No. 6436.
Working Foreman. Holbeach Gas-Works.

Book for Sale.

Cripps' Guide Framing of Gasholders. Offers to No. 6452.

Meeting.

Bombay Gas Company. Moorgate Street Chambers, E.C. May 30, 11.30 o'clock.

Plant, &c., for Sale.

Pipes. No. 6445.
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TENDERS FOR

Coal.

Blackpool County Borough.
Maidstone Gas Company. Tenders by May 29.
Tiverton Town Council. Tenders by June 1.

Tar and Liquor.

Loughborough Gas Department. Tenders by June 10.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

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(See p. 356.)

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